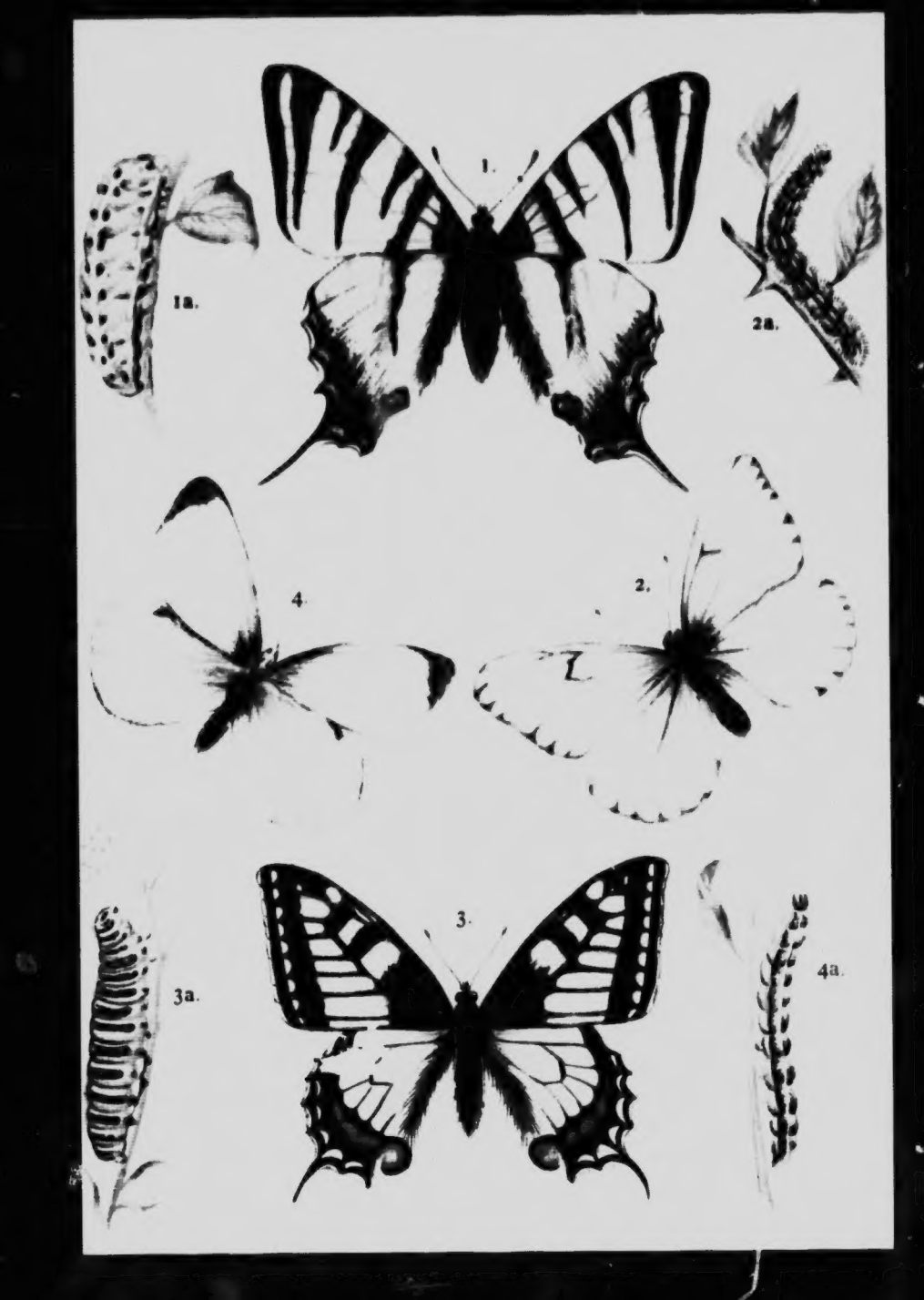
BUTTERFLIES AND MOTHS
AT HOME AND ABROAD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BUTTERFLIES AND MOTHS
AT HOME AND ABROAD

BY

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REFERENCE

WITH 21 FULL-PAGE PLATES

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TO

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FIRST OF FIELD NATURALISTS

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AUTHOR'S PREFACE

AN elementary work of this kind necessarily displays many imperfections. The subject is too wide for casual survey; the treatment of the few species of British butterflies and moths I have attempted to describe falls far short of what, as a naturalist, I am conscious it should be. My aim in writing, however, has been rather to guide and to suggest than to provide further material for advanced students; and I venture to hope that the indications given may induce those who are drawn towards Entomology, whether as pastime or study, to fill in the outlines for themselves from the inexhaustible Book of Nature.

The difficulty of painting scientific pictures accurately with the primary colours of simple language is acknowledged by advanced workers. I have tried to dispense with technicalities, but in some cases, of course, especially in my remarks upon classification and in the Second Part, I have been compelled to employ a certain number of special words and terms. None the less, I trust that, with the help of the explanations in the text, and of the colour plates, my meaning will be intelligible to beginners, to whom chiefly my remarks are addressed.

For many details I am indebted to "The Larvæ of the

Author's Preface

British Butterflies and Moths," by the late William Buckler, published by the Ray Society; and for the arrangement and nomenclature of the Super-Families, to "British Lepidoptera," by the late James W. Tutt—a great work, unhappily cut short last year by the premature death of the author.

H. R.-B.

January 1912.

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NOTE

Where authors' names are not given in full after the names of species they are abbreviated as follows:—

Bgstr.	Bergstrasser.	Och.	Ochsenheimer.
Bkh.	Borkhausen.	Pall.	Pallas.
Cl.	Clerck.	Rbr.	Rambur.
Don.	Donovan.	Rott.	Rottemburg.
Dbld.	Doubleday.	Schiff.	Schiffermüller.
Esp.	Esper.	Sc.	Scopoli.
F.	Fabricius.	Stt.	Stainton.
Fuessl.	Fuessly.	Stgr.	Staudinger.
Gern.	Gerning.	Thnb.	Thunberg.
Hb.	Hübner.	View.	Vieweg.
Hufn.	Hufnagel.	Wallgr.	Wallengren.
Haw.	Haworth.	Z.	Zeller.
Kn.	Knoch.	Zett.	Zetterstedt.
L.	Linnæus.		

LIST AND EXPLANATION OF THE PLATES.

The letter *a* denotes the larva of each species numbered.
m. = male, f. = female.

PLATE I. (*Frontispiece*).

1. *Iphiclides podalirius* . The Scarce Swallow-tail.
2. *Aporia crataegi* . The Black-veined White.
3. *Papilio machaon* . The Swallow-tail.
4. *Pieris brassicæ* . The Large White.

PLATE II. (*Facing page* 29).

1. *Parnassius apollo* . The Apollo Butterfly.
2. ,, *mnemosyne*.
3. *Euchloe cardamines* . Orange Tip.
4. *Pieris rapæ* . The Small White.
5. *Colias hyale* . Pale Clouded Yellow.
6. ,, *edusa* . Clouded Yellow.
7. *Thais polyxena*.

PLATE III. (*Cover*).

1. *Gonopteryx rhamni* . Brimstone Butterfly.
2. *Apatura iris* . The Purple Emperor.
3. ,, *ilia*.
4. *Limenitis populi*.
5. ,, *sibylla* . The White Admiral.

PLATE IV. (*Facing page* 78).

1. *Vanessa io* . Peacock Butterfly.
2. *Aglais urticæ* . Small Tortoise-shell.
3. *Eugonia polychloros* . Large Tortoise-shell.
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5. *Neptis aceris*.
6. *Polygonia c-album* . Comma Butterfly.

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3. ,, *athalia* . Heath Fritillary.
4. ,, *aurelia*.
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1. *Hamearis lucina* . Duke of Burgundy Fritillary.
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3. ,, *ligea*.
4. *Pararge egeria*, var. *egerides* . The Speckled Wood.
5. *Erebia medusa*.
6. *Pararge megæra* . Wall Butterfly.
7. *Satyrus hermione*.
8. *Canonympha pamphilus* . The Small Heath.
9. *Epinephele jurtina* . Meadow Brown.
10. *Strymon spini*.

List and Explanation of the Plates

PLATE VIII. (*Facing page* 128).

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3. *Plebeius argus* . . Silver-studded Blue.
4. *Polyommatus icarus* . Common Blue.
5. ,, *orion*.
6. *Agriades thetis* . . Azure Blue.
7. *Polyommatus damon*.
8. *Lycæna arion* . . Large Blue.
9. *Urbicola comma* . Silver-spotted Skipper.
10. *Cyclopides palæmon* . Chequered Skipper.
11. *Hesperia malvæ* . Grizzled Skipper.

PLATE IX. (*Facing page* 154).

1. *Exæreta ulmi*.
2. *Dicranura vinula* . Puss Moth.
3. *Cerura bifida* . . Poplar Kitten.
4. *Notodonta dictæa* . Pebble Prominent.
5. *Phalera bucephala* . Buff Tip.
6. *Euproctis chrysorrhœa* Brown Tail.
7. *Orgyia antiqua* . . The Vapourer.
8. *Lymantria monacha* . The Black Arches.

PLATE X. (*Facing page* 157).

1. *Lymantria dispar* . Gipsy Moth (m.).
2. ,, ,, . ,, (f.).
3. *Stilpnotia salicis* . Satin Moth.
4. *Porthesia similis* . Gold Tail.
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6. *Lasiocampa quercûs* . Oak Eggar.
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1. *Nola strigula* . . Small Black Arches.
2. *Earias chlorana* . Cream-bordered Green Pea.
3. *Syntomis phegea*.
4. *Arctia caia* . . Garden Tiger.
5. ,, *villica* . . Cream-spot Tiger.
6. *Callimorpha dominula* Scarlet Tiger.
7. ,, *quadripunctaria* . . . Jersey Tiger.

PLATE XII. (*Facing page* 163).

1. *Arctia aulica*.
2. *Rhyparia purpurata*.
3. *Parasemia plantaginis* Wood Tiger.
4. *Cybosia mesomella* . Four-dotted Footman.
5. *Hipocrite hœ* . The Cinnabar.
6. *Lithosia complana* . Scarce Footman.
7. *Pelosia muscerda* . Dotted Footman.
8. *Heterogynis penella*.
9. *Anthrocera loniceræ* . Narrow-bordered Five-spot Burnet.
10. ,, *filipendulæ* Six-spot Burnet.
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13. ,, *statices* . . The Forester.

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1. *Acronycta alni* . . Alder Moth.
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3. *Triphæna fimbria* . Broad-bordered Yellow Underwing.
4. ,, *ianthina* . Lesser Broad Border
5. ,, *pronuba* . Yellow Underwing.
6. *Noctua brunnea* . The Purple Clay.
7. *Agrotis segetum* . Turnip Moth.
8. *Pachnobia rubricosa* . The Red Chestnut.
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10. *Mamestra persicariæ* . The Dot.

PLATE XIV. (*Facing page* 172).

1. *Dianthœcia capsincola* The Lychnis.
2. *Diloba cæruleocephala* The Figure-of-Eight.
3. *Xylophasia rurea* . The Clouded-bordered Brindle.
4. *Agriopis aprilina* . Merveille-du-Jour.
5. *Mormo maura* . . The Old Lady.
6. *Nonagria typhæ* . The Bulrush Wainscot.
7. *Caradrina morpheus* . The Mottled Rustic.
8. *Amphipyra tragopogonis* . . . The Mouse.
9. *Amphipyra pyramidea* Copper Underwing.
10. *Panolis piniperda* . The Pine Beauty.

List and Explanation of the Plates

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2. *Cossus cossus* . . Goat Moth.
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4. *Trochilium sphecifor me* . . . White-barred Clearwing.
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6. *Ægeria apiformis* . Hornet Clearwing.
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3. *Plusia gamma* . The Silver Y.
4. *Pseudophia lunaris* . The Lunar Double Stripe.
5. *Catocala sponsa* . Dark Crimson Underwing.
6. ,, *electa.*
7. ,, *fulminea.*
8. *Brephos parthenias* . Orange Underwing.

PLATE XVII. (*Facing page* 196).

1. *Geometra papilionaria* Large Emerald.
2. *Operopthera brumata* . Winter Moth (m.).
3. ,, ,, ,, (f.).
4. *Thera juniperata* . Juniper Carpet.
5. *Abraxas glossulariata* Magpie Moth.
6. *Ennomos alniaria* . Canary-shouldered Thorn.
7. *Venilia maculata ia* . The Speckled Yellow.
8. *Lycia hirtaria* . . The Brindled Beauty.
9. *Gnophos obscuraria* . The Annulet.
10. *Ematurga atomaria* . Common Heath Moth.

PLATE XVIII. (*Facing page* 224).

1. *Acidalia aversata* . Ribband Wave Moth.
2. *Urapteryx sambucaria* Swallow-tailed Moth.
3. *Chloroclystis rectangulata* . . . The Green Pug.
4. *Eurrhypara urticata.*
5. *Xanthorhoe fluctuata* . The Garden Carpet.
6. *Opisthograptis luteolata* . . . Brimstone Moth.
7. *Nymphula stagnata* . The China Mark.
8. *Aglossa pinguinalis.*
9. *Tortrix viridana* . Green Oak Moth.
10. *Carpocapsa pomonella* Codlin Moth.
11. *Pyralis farinalis.*
12. *Tinea pellionella* . Clothes' Moth.
13. *Adela viridella.*
14. *Orneodes hexadactyla* . The Many Plume.
15. *Odezia atrata* . . The Chimney Sweeper.
16. *Pterophorus monodactylus* . . The Brown Plume.

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1. *Acherontia atropos* . Death's Head Hawk.
2. *Mimas tiliæ* . . Lime Hawk.
3. *Sphinx ocellata* . . Eyed Hawk.
4. *Amorpha populi* . Poplar Hawk.

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1. *Hyloicus ligustri* . Privet Hawk.
2. ,, *pinastri* . Pine Hawk.
3. *Celerio vespertilio* . Bat Hawk.
4. ,, *galii* . Bedstraw Hawk.
5. *Pergesa elpenor* . . Elephant Hawk.
6. *Hæmorrhagia tityus* . Narrow-bordered Bee Hawk.

PLATE XXI. (*Facing page* 250).

1. *Gastropacha quercifolia* . . . Lappet Moth.
2. *Dimorpha versicolora* . The Kentish Glory
3. *Dendrolimus pini.*
4. *Saturnia spini.*
5. *Aglia tau.*
6. *Drepana falcataria* . Pebble Hook-tip.
7. *Cilix glaucata* . . The Chinese Character.

BUTTERFLIES AND MOTHS AT HOME AND ABROAD

CHAPTER I

THE USES OF COLLECTING AND OBSERVATION

TIME was when the collector of butterflies and moths, and in greater degree the collector of other insects—beetles, flies, and the species of those several Orders into which the insect world is divided—was regarded more or less as a harmless lunatic. "What," asked the proverbial "man in the street," "what on earth is the *good* of catching and arranging in boxes hundreds of these insignificant creatures merely to indulge a miserly passion or a craving for treasures of no solid value?" That the collector might be the author of epoch-making discoveries affecting the common welfare of the human race; that the field naturalist, by amassing material, might assist the man behind the microscope in the museum and in the laboratory to arrive at useful conclusions and apply his knowledge for the universal benefit, never entered into the head of the heedless critic. A man or boy equipped with a green gauze net, a collecting-tin, or a satchel stuffed with pill-boxes, was a sufficiently absurd spectacle, and the idea of chasing butterflies by day and moths by night, so unusual as to excite the cheap wit which is a sure hall-mark of ignorance. But from the time when Darwin and Wallace published their momentous discoveries the tables were turned, and nowadays even the

humble " bug-hunter " may claim that in not a few recent discoveries in the theoretical Schools, and in Medicine especially, his colleagues have played a modest, yet by no means unuseful, part.

The close observation of the laws which govern the economy of insect life ; the necessary collection of specimens for this purpose ; and the stimulus afforded the reasoning powers of the observer, so that he may apply his collected facts about these smaller beings to the common fund of knowledge—these are considerations which justify the encouragement of a love for Nature study in children, who may presently find also that the hobby of their school days has become an absorbing scientific interest for the leisure of their whole lives.

Again, collecting itself, regarded wholly apart from the scientific ends to which it is primarily a means, and when reasonably pursued, conduces to soundness of mind and body alike. After some five-and-thirty years' experience of field-work, the author claims to have found the study of butterflies and moths at once an agreeable and intellectually profitable recreation. It has brought him in contact with many people : it has drawn him to many lands, from the white North, with its endless days of summer sunshine, to the glimmering lavender-haunted hills of the Mediterranean ; from the heather-fragrant mountains of Scotland to the " sheep-trimmed downs " and shadowed woodlands of the South of England : and he can, therefore, with all confidence, commend his favourite " sport " to the youngster who is also " heir to all the ages " in the spacious realms of Nature.

But whether the collection of butterflies and moths is made for such enjoyment as the chase and the place afford, and the hunter is content with such pleasure as the casual expedition brings with it, or whether he sets out with the

determination to go far and use his acquired wisdom to definite purpose, he may be assured that both ways make for the same end, which is "Knowledge," or, as otherwise expressed, "Science."

Let the beginner remember, also, that a chance capture or an apparently trivial observation may solve a long-debated problem or provide the clue to some hitherto unravelled mystery; while it is by no means to be objected that Entomology, even in the elementary stages, is altogether without practical uses.

A single example, perhaps, will best illustrate my meaning. Some years ago, after the death of Robert Louis Stevenson, the writer of "Treasure Island" and many other delightful books and essays, the question arose whether certain of his works had been written in England, in the United States, or in his last Pacific island-home. The manuscripts turned up in London, but not the key to the puzzle, which might have raised important questions of copyright. Between the sheets, however, there was found a tiny fly. The insect was submitted to an expert entomologist, who at once pronounced it as belonging to a race peculiar to the Samoan Islands—and the riddle was answered!

In the wider field of Agriculture, and especially in the branch of Science which is called Economic Entomology, the field naturalist has given invaluable assistance to the farmer and fruit-grower. Apparently the chief *use* of insects to mankind lies in their capacity to absorb and destroy vegetable matter, which without their assistance would become a danger in decay to human life, or possibly in some countries by excessive luxuriance of growth. The function of insects, however, is extended beyond merely destructive powers. Just as some of them prey upon and keep down the smaller fry upon which they sustain existence, so they in turn

provide food for the higher organisations of birds, beasts, and even fishes; and thus, apart entirely from any human considerations, they perform a definite and important part in the ordered life of the Universe.

Still, it often happens that from one cause or another—climatic conditions exceptionally favourable to development, or the wholesale destruction of birds, which are their natural enemies—insects increase and multiply to a prodigious extent. And then, in the caterpillar phase, they turn their attention to crops, orchards, and market-gardens, with disastrous results. The larvæ of butterflies and moths are the least among such offenders; but there are not a few of them on the "Black List," and to combat their ravages knowledge of their life history is indispensable, and also of "the little fleas that bite 'em," since by the introduction of the natural parasite within the infected area we may often get rid of the host altogether.

Perhaps the only British butterfly, strictly speaking, which comes within the criminal category is the "Large Cabbage White," *Pieris brassicæ*, and in less degree his first cousin, the "Small Cabbage White," *P. rapæ*. Both of them are terribly destructive in the kitchen garden, though the latter is by no means confined in its attentions to the cabbage, which in the North of Europe particularly forms the staple of winter greenstuff. Among the moths there are many which do irreparable damage to the roots, as well as to the foliage of plants and trees. In America the "Gypsy Moth"—fortunately not indigenous to Britain, or only regarded as such from having been reared there for the benefit of the collector—plays havoc with the hawthorn hedges. I myself have seen long avenues of poplar, such as line the dusty highways of northern France, stripped of every green leaf, and, in place of "the whispering shade,"

Medusa-like coils of the caterpillar of the "Satin Moth," *Stilpnotia salicis*, falling in thousands from the naked branches to perish miserably on the road beneath. In England a common sight is the oak coppice denuded of its first spring verdure by the larva of the lovely little "Green Oak Moth," *Tortrix viridana;* while on the currant bushes the withered twigs and failing fruit clusters reveal the presence in the pith of the "Currant Clearwing," *Trochilium tabuliforme;* or the dying willow, permeated with the disgusting "goaty" odour of the "Goat Moth," *Cossus cossus*, testifies to yet another most destructive internal feeder. The larvæ of the Swift Moths, and especially of the "Common Swift," *Hepialus lupulina*, assail the roots of many useful plants; while whole pastures have been destroyed by the voracious larvæ of that graceful little Noctuid, *Charæas graminis;* our apples by the "Codlin Moth," *Carpocapsa pomonella;* and our roses by the all too familiar "Brown Cloak," *Notocelia roborana*. And lastly, as illustrating the collective mischief wrought by the larvæ of a moth, I may mention the widespread havoc in young fir plantations abroad due to the gregarious Noctuid, *Thaumetopœa processionea*, which derives its suggestive name from the ant-like habit of making its journeys to "fresh woods and pastures new" in long unbroken lines of march.

These few examples, then, illustrate the value of close observation of butterflies and moths in all their developments; for without complete and detailed information as to their habits we should be entirely in the dark for a remedy against their attacks. In which connection, also, I cannot refrain from citing one more instance of the signal service rendered by a naturalist whose powers of observation have proved of inestimable benefit to the sugar-planting industry.

Butterflies and Moths

Some years ago the West Indian Government appointed a consulting entomologist for the island of Jamaica. For a long time previous a mysterious disease had decimated the canes, and employers were at their wits' end to find the cause of it. Some suggested that it was a case of poisoned soil; others that there was something amiss with the methods of cultivation; but, while a few may have suspected the real evil, no one could properly locate it. Mr Maxwell-Lefroy had not taken up his duties long, therefore, when he was approached on the subject, and, after a short investigation, not only attributed the failure of the plantations to the depredations of the larva of a common West Indian moth, but speedily found a wholesale means to exterminate the pest.

That noxious insects should be destroyed, and that we are fully justified in assisting Nature to this extent, no one is likely to deny. No mercy, further, is conceded the plague-transmitting Mosquito, or even that useful scavenger, the Wasp. But in this connection it is often urged that the collection of butterflies and moths is immoral, inasmuch as it implies the destruction, for no legitimate reason, of conscious life which it is impossible to give back or to renew. The proposition admits of but one answer if the destruction of life is unjustified. The collector who goes out slaughtering everything he comes across, good, bad, and indifferent specimens alike, without discrimination, and throws away such as have no *commercial* value, is outside the pale. But for every one such as he there are hundreds who wield the net in less uncompromising fashion. The beginner may content himself with a few examples of the butterflies and moths he comes across on his expeditions or rears in his breeding-cages. These few will suffice to give him the requisite preliminary knowledge of each species; and he

may safely forego the accumulation of long series, unless he is providing for the more advanced student engaged upon scientific research, and to whom the commonest insects, *in large quantities*, afford often the best material, since it is through the most abundant groups which inhabit our islands and the Continent that the processes and experiments of Nature may best be determined. But the laws of variation, as bearing upon "natural selection" and the "survival of the fittest," are subjects on which we need not enter here. The object of writing this book is to guide the collector, and not to trespass upon the domain of that pure science of which, none the less, as I have endeavoured to show, he may and should become the useful ally.

CHAPTER II

ENTOMOLOGY: ITS MEANING—THE EGG—THE LARVA—THE PUPA—THE PERFECT INSECT—TERMS EMPLOYED TO DESCRIBE THEIR STRUCTURE.

EVEN half a century ago a number of British Lepidoptera —chiefly moths—were unknown. Many of the species with which we are familiar enough to-day were regarded as rarities; not a few were wrongly accredited as natives on slender evidence. The work of observation, carried on by successive generations of collectors and museum-workers, has changed all this; and though there yet remains to be done an incalculable amount of work in discovering and recording their life-histories, we are in a better position now than ever before to sum up the riches of our British butterflies and moths.

To begin with, it will be as well to explain the meaning of the words in common use in our special branch. The word "entomology" itself is derived from the Greek ἐν (in), and τέμνω (I cut), with the λόγος (word, or study) added, the whole, therefore, implying the study of a creature which, roughly speaking, is "incut"—that is to say, divided up into sections—thorax and abdomen. The word "Lepidoptera" is derived from two more Greek words, λεπίς (a scale), and πτέρα (wings), thus indicating that this particular order of insects is further distinguished by having the wings scaled, or "feathered," in contradistinction to many

insects (and even a few moths) whose wings are transparent and unscaled.

Our Lepidoptera, or Scale-wings, then, are divided up into Rhopalocera (butterflies), and Heterocera (moths)—that is to say, butterflies having club-horns (Greek, *ῥόπαλον*, club; *κέρας*, horn) or antennæ; and moths having "horns" or antennæ otherwise arranged (*ἕτερος* = of other forms).

There are few British or Continental Lepidoptera in which the distinction is not immediately apparent. In the Tropics there are butterflies with antennæ unclubbed; among the moths, as in the "Burnet" group (Plate XII., Figs. 9-10), we find species apparently possessing clubbed antennæ, but easily distinguishable otherwise from butterflies by the shape of their bodies, etc. Again, it is only partially correct, but a sufficient general distinction, to say that butterflies affect the day and moths the night. Butterflies are day-fliers naturally, the majority of moths night-fliers; yet quite a number of the latter, as we shall see later on, may be included with the sun-loving insects of mountain, field, and forest.

Besides this distinction of the antennæ and of the hours of flight, there are other and easily ascertained differences between the two great divisions of Lepidoptera. A butterfly at rest sits with the wings upright above the back, one family only, 'Skippers," which in habits and appearance are often decidedly moth-like, varying the rule by dropping the hind wings level with the body; and one of them, our "Dingy Skipper," *Nisoniades tages*, actually adopts the moth plan of *folding the wings over the body*. A closer examination of any moth and butterfly reveals the fact that the fore and hind wings of most of the former are connected by a small fibrous process (known as the *frenum*)

used to "lock," as it were, the pairs of wings together; while the wings of the butterfly are structurally independent of each other. Also, it is usually the case that, while the butterfly thorax and abdomen are smooth, those of the moth are tufted, or adorned with a more or less plentiful coating of down. To this rule there are exceptions, of course; but they are few and far between, and need not detain us.

Having thus stated briefly the visible indications which distinguish butterfly from moth—indications, that is, to be observed in the perfect and winged period of their existence—I pass on to the several metamorphoses, or PHASES, through which a lepidopterous insect proceeds before it appears on the scene as "the finished article." We can consider the two together, for every moth or butterfly, large or small, passes through four phases in themselves wholly and totally different to one another—the first and third *apparently* quiet and inactive; the second and fourth active and energetic. Thus from (i.) the OVUM, or EGG, is developed (ii.) the LARVA, or CATERPILLAR, which again turns into (iii.) the PUPA, or CHRYSALIS, from which eventually emerges (iv.) the IMAGO, or completed example of its race; the dissected larva, indeed, revealing under the microscope the astonishing fact that it contains within its body the "ground-material" for the several organs, even the wings, necessary to subsequent and final development. And in this last phase it should be noted that when once the wings are fully expanded the insect is incapable of growth during the rest of its existence. So that there is nothing like a baby stage for the butterfly. Rather it comes from the pupa fully equipped, as in the old Greek fairy-tale Athena sprang, armed *cap-à-pie*, from the head of Father Zeus!

The accompanying illustrations are intended to show the characteristic form and shape of egg, larva, pupa, and

imago, and the designer, Mr. R. M. Prideaux, has presented them so that the necessary descriptive terms, employed in the Second Part of this book especially, may be understood easily. Descriptions, however, unaccompanied by illustrations, are but incomplete guides to identification; and, recognising that in a work of this kind the utmost directness is required, I shall endeavour to dispense with technical language as far as possible.

(i.) The appearance of the magnified egg, as shown by Figs. 1 and 2, requires no further comment beyond this—that the shape and adornment, the sculpture of the shell, its relative elaboration and simplicity of design, vary with the several head families in which our Lepidoptera are grouped, and individually as well.

FIG. 1.

FIG 2.

Fig. 1 represents a typical "upright" butterfly egg.

Fig. 2 represents a typical flat Geometer and Sphingid egg.

(ii.) To avoid minute and lengthy descriptions I shall deal with the larvæ only as they appear when full fed. But in some families so various are the colours and markings of a single species that it is by no means easy even for advanced collectors immediately to recognise their captures thereby.

Fig. 3, the larval body (Latin, *larva*, a mask), is composed of a head and twelve divisions, or segments (rings): the first three belong to the thorax—the part immediately behind the head; the remainder to the abdomen. The former are provided each of them with a pair of (true) legs; the two segments next them have none; the remainder have

stouter fleshy legs (prolegs or claspers), or perhaps it is better to designate them "feet." The legs on the thorax develop the six (usual) legs of the perfect insect; the abdominal legs vary in number, according to species, and disappear altogether in the final phase. The larva breathes through openings, rather suggestive of port-holes, placed in the sides of the first thoracic, and first eight abdominal segments. They are called "spiracles."

Figs. 3 and 4 show (*a*) the head; (*bb*) thoracic segments;

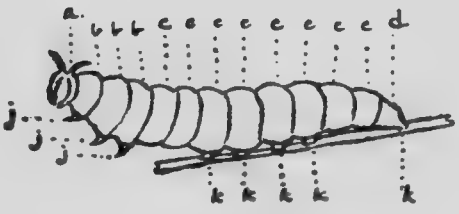


FIG. 3.

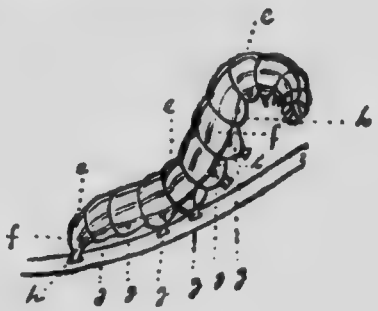


FIG. 4.

(*cc*) abdominal segments; (*d*) anal segment; (*e*) back, or dorsal markings; (*f*) side, or lateral stripe; (*gg*) spiracles; (*h*) spiracular stripe; (*j*) true legs; (*k*) prolegs.

Of the interior economy of the larva I need say no more here than that it is provided with a silk-spinning apparatus and a necessarily large stomach, as practically the whole bodily nourishment of the insect is taken in the larval phase.

(iii.) The shape and appearance of the pupa (Latin, *pupa*, a doll) vary indefinitely. I reject the term "chrysalis" as applicable only to the gilded or metallic form. The pupa is covered with a hardened secretion, and, as in the case of many of the perfect insects, no

further protection is afforded beyond what is secured by similarity to surroundings. This cocoonless form is known as the obtected; the form requiring a cocoon as the

FIG. 5.

FIG 5A.

FIG. 6.

incomplete: (*a*) OBTECTÆ, and (*b*) INCOMPLETÆ. Examples are shown, Figs. 5, 5*a*, of the former, and Fig. 6 of the latter. In Figs. 5 and 6, the spiracles are clearly marked on the segments.

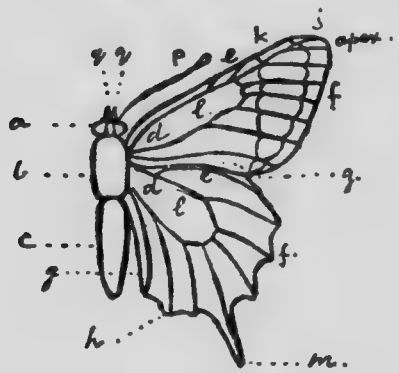


FIG. 7.

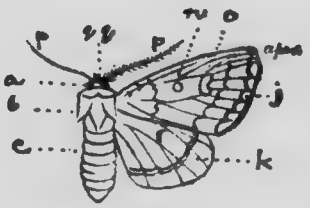


FIG. 8.

(iv.) The body of the imago, or perfect insect, is divided into (*a*) the head; (*b*) the thorax; (*c*) the abdomen. The four wings are supported by tubular "nervures," and for descriptive purposes I employ the following terms:—

Fig. 7: butterfly, showing wing nervures; (*d*) wing bases; (*e*) costal margin; (*f*) outer margin; (*g*) inner margin; (*h*) anal angle; (*i*) marginal band; (*k*) ante-marginal band; (*l*) discal, or discoidal, cell spot; (*m*) "tail." Fig. 8: moth: the same terms applicable where necessary; and (*n*) orbicular spot, or stigma; (*o*) reniform (kidney-shaped) spot. Both figures: (*pp*) antennæ; (*qq*) palpi.

CHAPTER III

CLASSIFICATION—NAMES, SCIENTIFIC AND POPULAR—MEANING OF TERMS—A LIST OF THE SUPER-FAMILIES OF LEPIDOPTERA.

OUR older authors laboured under the comfortable delusion that the British butterflies, and in great measure also the moths, could be conveniently parcelled off into a few easily determined races or genera. With the expansion of knowledge on the subject we have to admit that, convenient though the system may be, it is entirely unscientific; and that, while not a few species were grouped correctly—often as much by accident as by design—there are as many and more whose place in the groups arranged by our entomological forefathers was entirely incorrect. The result, as might be expected, is that the scheme, as well as the nomenclature, of our British catalogues is still somewhat of chaos—highly disconcerting and discouraging to the beginner when he wishes to set in order his cabinet drawers and store-boxes with the name-lists supplied by English and German dealers. In fact, to be up-to-date he will have to consult the several modern works written upon each special Family, though I shall employ in this book only such scientific names for species as are sanctioned by reliable authority.

The first naturalist to recognise the possibility and invent a scientific system of classification was Carolus Linnæus, or Linné, of Sweden. As a great English admirer has written

of him, "he sifted out with unrivalled skill the observations of his predecessors, separating the ore from the dross, and concentrating the scattered rays of light on to one focus." Of his several editions of the "Systema Naturæ" no more need be said here than that their author determined the place of our Lepidoptera in the order of Nature, and eventually invented the second or "*specific*" name in addition to the race or *generic* name which at first was all the insect had boasted. From his Insect Sub-Kingdom of Arthropoda (jointed feet) he made a further division of water (Branchiata) and air-breathing creatures (Tracheata), and it is from the latter that the Lepidoptera are derived.

So far all is plain sailing. It is when we come to divide up the butterflies and moths into their respective families and races that the trouble begins; and as "classification is an interpretation of facts," and "the facts are, to a great extent, details of anatomy and morphology of the beings classified," it is clear that until we have before us all possible information concerning our subjects we cannot hope for complete and accurate arrangement. "The first step," therefore, towards a correct classification is to find out as many facts as possible," [1] bearing in mind that "no scheme of classification that is not founded upon a consideration of the structural details and peculiarities of the insects *in all their stages* can be considered as really sound or as founded upon a *natural basis*." [2]

Linnæus, who described thousands of species of plants as well as insects, could hardly be expected to give that close attention to the details of everything enumerated. Thus his arrangement was more or less experimental, and based upon observations in the field which in their turn suggested

[1] Rothschild and Jordan, "Novitates Zoologicæ," Sphingidæ.
[2] Tutt, "British Lepidoptera," vol. i. p. 103.

1.
5.
2.
3a.
7a.
4.
5a.
7.
6.
4a.
1a.
2a.
3.
6a.

the relationships of the butterflies and moths one to another, as they appeared *probable*. Nor was it until many years after that a serious attempt was made to arrange the races in their proper places; and the field naturalist discovered for himself that Linnæus had not infrequently described as actual species forms which in reality were but varieties and aberrations of what we should now call "the TYPE" or representative insect of each several race or genus. In this brief survey of the beginnings of classification I do not propose to enter more fully upon what is a highly controversial subject. Sufficient to accept, so far as possible, the results of modern enquiry and make use of its conclusions.

Butterflies and moths are divided into (i.) super-families; (ii.) families; (iii.) sub-families; (iv.) tribes; (v.) genera; and (vi.) species. And as an illustration of this method I may take the case of the western "Swallow-tails." (i.) Their SUPER-FAMILY—*Papilionides*—is that of all the butterflies except the "Skippers"; (ii.) their FAMILY—*Papilionidæ*—is made up of all the "Swallow-tails," the Thaids (p. 117), and the Parnassiids (*ibid.*); (iii.) their SUB-FAMILY consists of "Swallow-tails" only; (v.) the GENERA of which the sub-family is composed in Europe are (*a*) *Iphiclides* (the genus of the "Scarce Swallow-tail") and (*b*) *Papilio*; (vi.) the SPECIES included in the genus *Papilio* are *Papilio machaon*, *P. alexanor*, and *P. hospiton* (p. 119).

To simplify matters I shall omit altogether the subdivision of (iv.)—the TRIBE; while I may add that by the word GENUS I mean a race of insects having certain structural details in common in all (or part of) their metamorphoses; by true SPECIES, a member of the genus, structurally distinct from other members, and, therefore, incapable of interbreeding, as varieties and aberrations of the same species are able to do within the limit of their species. Further,

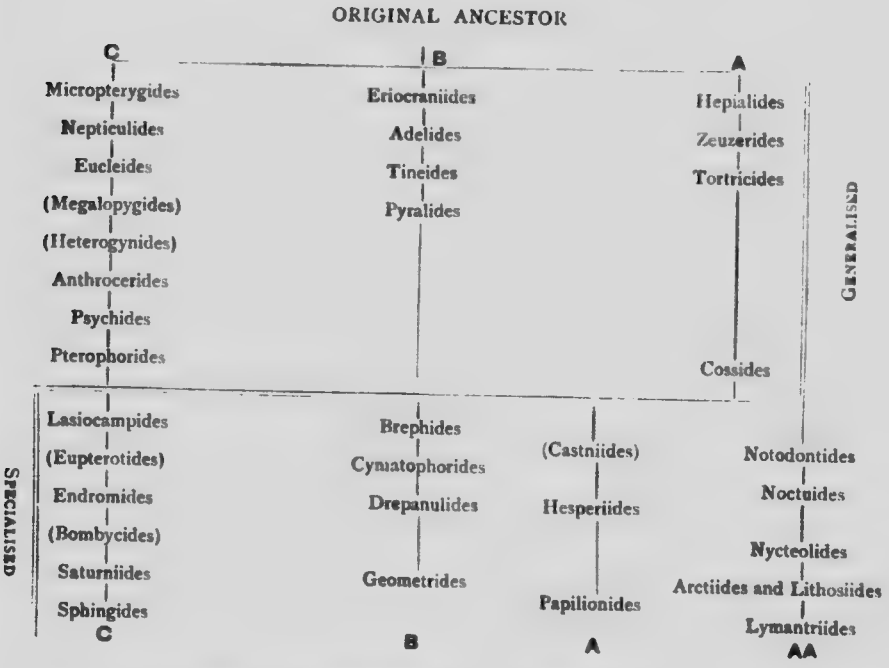
by the word VARIETY (written VAR.) I mean a constant race of an individual species of butterfly, *structurally* inseparable from the TYPE or normal form of that species, but differing outwardly in markings, coloration, or even in the shape of the wings. Thus, when we speak of *Colias edusa*, var. *pallida*, Tutt, we mean that the female "Clouded Yellow" (in almost every locality where it occurs) possesses a pale form, and that the name was first given to it as such by Tutt. An ABERRATION (AB.) has been best defined as applying to "individuals which stand outside the normal range of variation." Thus, by *Polyommatus icarus*, ab. *striata*, we mean that the "Common Blue" *sometimes* presents the form so described, and, presumably, it may occur anywhere over the region occupied by this species of butterfly. Again, the term "SUB-SPECIES" is used to designate a *geographical* race of the same species occurring elsewhere than in the haunts of the type-species itself; and by some writers it is used as a synonym for "variety."

Lastly, the word FORMA or FORM is applied in case of species which develop in a single season two or more forms, often differing entirely in appearance from the type. In the Tropics many species exhibit a "wet season" and a "dry season" form. Nearer home, I may mention the "Map" Butterfly (the French call it "La Carte géographique"), *Araschnia levana*, which in the second, or summer generation presents a wholly different aspect from that of the parent spring brood. For the summer form *prorsa* is not a *variety;* it is not an *aberration;* it is not a *sub-species:* it is *Araschnia levana* itself, and is properly described, therefore, as *A. levana prorsa*.

Meanwhile the arrangement of super- and sub-families, tribes, genera, and species remains a subject of endless discussion in the scientific world. From the following table

it will be seen that so far as the super-families are concerned an established order has been achieved. though it is too much to expect that, even on present known facts, entomologists will consent unanimously to be guided by it.

Butterflies and moths, then, being descended from a common, and in point of time an extremely remote, ancestor, fall into two natural divisions—(i.) according as they have developed structurally from *generalised*—that is, more simple and helpless, insects—into (ii.) more perfect, capable, and well-equipped, and therefore *specialised* insects, branching into three main lines of descent, as set out below in the series A, AA, B, and C.



But it must be understood that, while the three topmost *generalised* families are so close together (yet so separate

from those that immediately follow them) that they may be regarded as interchangeable, each one of the lowest of each branch of the *specialised* families is far from the lowest of the other series; also that the exact order in each series indicates roughly that the lower is more specialised and the higher less so, but does not imply that those placed most closely together are necessarily t[illegible]st related, still less that they form a series each developed from the one above it. In my arrangement of super-families in the Second Part of this volume it will be seen that I commence with the butterflies, *Papilionides* and *Hesperiides*, and therefore one of the most specialised series. Those marked on the "family tree" in brackets are not represented in the British Islands.

With these observations I would impress on all beginners the advisability of mastering the scientific names of the Lepidoptera. Most of the butterflies of the United Kingdom possess homely names, but they are intelligible only to ourselves, for each country has its own particular synonyms for the same. Some are well chosen; but when we come to the rarer and less obvious insects it will be found that no alternatives exist in the "vulgar tongue." To illustrate my first point I may mention the "Purple Emperor" of England, *Apatura iris* (Plate III., Fig. 2). In France it is known as "Le Grand Mars"; in Germany (more faithful to the classic tradition of *Iris*) it is the "Large Lustre Butterfly." But when a less conspicuous butterfly is cited, the popular writer is forced back upon the scientific name; for example, the marsh-loving "Heath" of south-western France, and the Doubs—*Cœnonympha œdipus*—in the text-books has no French equivalent. Nor is there any reason why, for British species, the classical names should be rejected on the score of difficulty; while

it may be urged further in favour of their use that they supply the only means whereby insects can be identified by collectors of all nations. The butterflies of Europe being first in the field for classical denominations, most of them are endowed with beautiful names; many of them conferred in direct reference to some fact of their life-history; though in this respect it must be confessed that sometimes the choice is misleading, by reason, no doubt, of partial or incorrect information as to habits, etc. *Zephyrus betulæ*, our "Brown Hairstreak," in Britain has no more to do with the birch tree than its foreign cousin *Strymon acaciæ* with the acacia. The larvæ of both species feed upon sloe; and, in my experience, neither insect affects birch or acacia woods. *Strymon pruni*, the rare "Black Hairstreak," on the contrary, does feed upon sloe, and *Bithys quercûs*, the "Purple Hairstreak," upon oak; while, in the case of the common "Brimstone" (Plate III., Fig. 1), both its generic and specific names apply to the "angle-winged butterfly of the buckthorn," *Gonopteryx rhamni*. The unfortunate part of it is that the classic mine is not inexhaustible, and that, nowadays, the discovery of a new moth or butterfly may lead to the employment of harsh-sounding and often grotesque hybrids such as *browni*, *klugii*, and even *blacki!*

Of the traditional names of our butterflies, however, this may be said in their favour. They are intelligible to English ears. When we come to the moths, it is an entirely "different pair of shoes." The classical dictionary has provided a reasonable specific nomenclature for them, where British imagination, in the majority of instances, has failed woefully. I think we must hold Moses Harris and the great Haworth responsible for the most incongruous names of moths adopted, and, it may be, expanded, by subsequent generations of writers down to the present day. But who

ever heard a collector speak of the " Middle-barred Minor," the " Suspected," the " Confused," or the " Tawny Shears " ? And I could quote a hundred names equally inept, and, to coin an appropriate adjective, " jargonic."

Happily for the Micro-lepidoptera, as they were formerly divided, no British author has attempted to " popularise " the group by labelling the whole of these tiny and exquisite moths with cumbrous Anglo-Saxon synonyms. For the Micros are seldom taken up by beginners in entomology, and have thus escaped the fate which has befallen so many of their big " brother " Macros ; though recent classification has shifted into the first mentioned (and now discredited) division of " the littles," or below it, not a few moths formerly ranked as " big 'uns." For example, the *Hepialides*, or " Swifts," have been relegated by some to that position in their series occupied by the *Micropterygides*, where the Lepidoptera come nearest to the " Caddis-flies " of the Order *Trichoptera*, which in the manner of their life they resemble very closely. Another family, " The Snouts " or *Hypenidæ*, have been promoted to the Noctuas ; while certain more obvious Noctuids like *Halias prasinana*, the " Green Silver Lines," and *Earias chlorana*, the " Cream-bordered Green Pea " (!) have been adopted into the same category from the Tortricids, or " Leaf Rollers."

CHAPTER IV

REARING AND BREEDING

Not the least important work of the collector and observer consists of breeding and rearing his butterflies and moths from the egg to the final imago. Dr Sharp in the "Cambridge Natural History" (*Insects*, Part II.) rates the intelligence of Lepidoptera as inferior to that of Hymenoptera (which Order includes bees, wasps, and ants); in mechanical adaptation of the parts of the body inferior to Coleoptera (beetles); but in perfection of metamorphosis second only to Diptera (flies).

It is with the metamorphoses, or life-changes of the butterfly and moth, that I now propose to deal; and in this connection, though much has been written to throw light upon the natural history of our British species, an immense field of discovery lies open to the collector who, not content merely to "educate" his larvæ, makes careful note of the appearance, habits, and peculiarities of even the commonest species, as presented in the several stages of their development. In the previous chapter I dealt with the general structures of egg, larva, pupa, and imago; it remains for the collector to fill in the details of each species from his own experience. Meanwhile, some general hints upon the subject of artificial rearing may not be out of place.

In the case of eggs, they require less attention than any other phase of the insect's journey through life. They may

be kept safely in chip-boxes, air-tight glass tubes, or, indeed, anywhere out of reach of their natural enemies—birds, spiders, preying insects, etc. They may also be sent through the post in quills stopped with cotton-wool, or in small pieces of grooved wood covered with a flat wood, cardboard, or stiff "lid." But in this case great care should be taken, especially when the transit is likely to be prolonged, to anticipate the possibility of the young larva hatching out *en route*. If there be the least chance of this happening, it will be best to pack in a small glass tube such as I have just mentioned, together with a portion of the food plant. Often, however, the collector receives or finds eggs which he is unable to identify, and as in nine cases out of ten he will have no more information to guide him beyond that "the egg of this species is green," and "the egg of that species is white," he will have to consider carefully the surroundings from which the unknown ova were derived. The majority of butterflies and moths, of course, deposit their eggs upon the tree or plant which is to provide the future family with food. But there are exceptions to the rule, and, for example, until quite recently it was not known, or at all events recorded, that the locally common "Silver-washed Fritillary," *Dryas paphia* (Plate VI., Fig. 4), instead of laying on the dog violet (*Viola canina*), which is its habitual food plant, and as such liable to destruction during the winter when the ova are hibernating, inserts its eggs in the crevices of bark upon a nearly neighbouring tree trunk.

As regards our British butterflies, the expert will have no difficulty in distinguishing their respective ova, even when transmitted away from the haunts of the species. But under similar circumstances the eggs of many moths are not so readily to be determined, and in captivity the young larva often comes into the world only to die of starvation. To

avoid a disaster of the kind, the collector may, perhaps, successfully tempt the little stranger to attack the leaves of lettuce; for, in an emergency, a large number of Noctuid species will adopt this plant. In any case, close observation should be kept of the ova to note the changes which indicate the approaching birth of the baby larva; though in some species the moment is difficult to anticipate because the occupant has been long formed within its shell; a case in point, the larva of the "High Brown Fritillary" passing the winter fully developed inside its "cradle." Usually a darkening of the colour, or the appearance of the tiny larva itself behind the now transparent walls of the egg, heralds coming emergence. And not infrequently its first meal is made upon the now empty shell.

With very young and very small larvæ I confidently recommend the use of air-tight metal boxes with glass bottoms, about the size of the cardboard boxes in which the ordinary mixed elastic bands are sold. The cover should have a piece of blotting paper fixed in it so that it can be moistened, and in this receptacle a sprig or even a leaf of the requisite food plant can be kept for a week together. Abroad, I have preserved the leaves of the honeysuckle fresh for a fortnight by such an arrangement, and brought the young larvæ upon them successfully forward to the stage when it is necessary to give them larger quarters and food in greater abundance. The larvæ of "Micros" and such like atomies may be safely housed with their food in air-tight tubes until the pupal phase.

With larger larvæ all sorts of devices are in favour, and there are about as many opinions as to the best breeding-"cage" as there are collectors. Certain it is, however, that the nearer the "prison" approximates to the surroundings of the larva in Nature, the better hope of successful results.

For this reason, the very best plan, where possible, is to "sleeve out" the larvæ; that is to say, to secure them upon a particular branch by placing a muslin bag over the whole of the area in which it is desired to confine them. They are then left to themselves; if their habit is to pupate into ground—until they are full fed; if to spin up in dead leaves, then they may be trusted to find a haven in the waste accumulated at the bottom of the bag itself. The old-fashioned stereotyped pattern breeding-cage—a square box with two sides and top zinc, one side glass, and a door occupying the whole or part of the back, I do not recommend. To begin with the space is cramped; the difficulty of cleaning great; and still more so of assuring a current of fresh air, as essential to some larvæ as to human lungs; while, unless great care is taken to keep the earth fresh in which the larva is to pupate, it will become stale and mouldy, and inevitably injure the larva or soft pupa.

My own method—that is to say, the method I adopt, for it is not my invention—is to have a flower-pot ready in which a healthy food plant is growing, whenever it is possible to anticipate the possession of larvæ of known species. This I cover over with a muslin cylinder, supported either by bamboo canes stuck into the soil all round the circumference of the pot, or, better still, ballooned on wires after the gardener's fashion for growing hot-house creepers, etc. The bag is then tied up at both ends, the lower end drawn in tight by means of a running tape or string, or simply held close to the pot rim by a stout elastic band. For butterfly larvæ, such of them as are day-feeders, the pot should then be placed in a sunny window seat, or upon the sill, and all that the collector has to do is to see that the plant is well watered, and, if entirely consumed, to transfer the larvæ from one pot to another. Very small larvæ should never be "fingered";

with a camel-hair brush, ever so slightly damped, you can take them up without injury, and lift them bodily to the desired spot.

These remarks do not alone apply to plant and grass feeders. A large number of moths in the larval phase consume the pith of twigs, or the soft insides of the reed For such, the twigs should be stuck into damp (not wet) sand, and the reeds treated in the same way ; and they can then be left alone until the moth actually emerges, pupation also taking place within the stem. Practically the whole of the " Clearwings," *Ægeriidæ*, as well as our " Bee Hawks," *Hæmorraghia tityus* (Plate XX., Fig. 6), and *H. fuciformis*, pass their lives in galleries bored in the living wood until they emerge as perfect insects ; our " Wainscots," Nonagrias (e.g., *Nonagria typhæ*, Plate XIV., Fig. 6), similarly affect the reeds which harbour many fen-loving insects, and the collector will soon learn in likely localities to decide by the sickly appearance of plants whether or not they are infested by such larvæ.

But there are many disappointments in store for even the most careful and conscientious breeders. For apparently unknown reasons, young larvæ, which have been feeding well in the early stages, suddenly sicken and die ; and epidemics of an equally mysterious nature will sometimes destroy the most promising broods wholesale. As a rule, overcrowding, which in not a few instances leads to cannibalism, or a too " sappy " diet induces sickness. There come diseases, however, which have not yet been diagnosed ; and very heart-breaking they are when the patient is one of the " undescribed," or wholly strange to the observer, awaiting identification by means of the resultant butterfly or moth. I can only repeat that the best chance of success lies in constant attention to diet and surroundings.

Especially must the collector be on his guard when winter sets in, and he is keeping hibernating larvæ. A few of them, and many of the Noctuids, will nibble all through the cold months, and generally for these, being indiscriminate—polyphagous—feeders, groundsel, or other winter weeds, and even chopped slices of carrot, will suffice. But with hairy larvæ mould is the most dangerous enemy, and as in a natural state a majority of such creatures fall victims to fungus growths in our humid climate, so is the difficulty enhanced under artificial conditions. For keeping the hibernating larva too dry is as bad for its health as over-doing the damp. Larvæ in pots or sleeves had best be left *in the open air* to take their chance, or may be stored in a cool, dry cellar ; when those which have descended into the moss, litter, or loose earth at the bottom of their cages should be left undisturbed.

There are also many which at some stage of their larval development require a complete change of food and treatment. Notably is this the case with the " Large Blue," *Lycæna arion* (Plate VIII., Fig. 8) ; and it was not until a naturalist discovered that most of the " Blue " larvæ (but not all) require the attention of ants, and even the seclusion of the ant-hill, to perfect their metamorphosis, that the missing link in the life-history of our rarest *Lycæna* was established. Several collectors had brought up the young larva to a certain point on the wild thyme (*Thymus serpyllum*), which is its first pabulum ; it never occurred to any one that the proximity of the ant-hill in the localities where *Arion* still survived had a direct bearing upon its development. Even now, we are unable to determine precisely the part played by the host to the guest, on what the larva feeds, or is fed, in the ant's nest ; and what he pays, so to speak, for his board and lodging. The omission

of the ant-heap in the artificial breeding arrangement for the "Large Blue," however, explains past failures to command success; and, no doubt, failures with other insects are due to want of kindred knowledge.

As an instance, also, of the havoc caused, presumably by damp, among hibernating larvæ, I may cite the Fox Moth, *Macrothylacia rubi* (Plate X., Fig. 7*a*). Any one who has tramped the Scotch hills in September and October will have been struck by the countless numbers of these fine velvety-looking larvæ, lying everywhere on the open heather. I have seen them on the moors of Edinample, in Perthshire, where they might have been collected by the bucketful. Still the larvæ were comparatively rare in the spring, and the moth even more so; while there is no hibernator more difficult to rear.

From what I have said it is clear that an acquaintance with botany, however slight, is of immense use to the breeder. Our rarest insects do not necessarily affect the rarest plants; but it often happens in field experience that, having secured certain desired larvæ, the stock of food plant gives out, and there is no possibility of renewing it. Some species will adopt *allied* plants as a substitute and flourish upon them; though it by no means follows that they will continue to enjoy such substitute indefinitely. And here comes in the botanist; for, without his help, we may have the *allied* plant at our doors, and yet be unable to recognise it. Many tropical insects by such means are reared in England. I myself have to thank a botanical friend for suggesting the "Dutchman's pipe" of our garden walls (*Aristolochia clematitis*) as a substitute for the unprocurable and queer-scented *Aristolochia pistolochia*, on which I had started a hopeful family of *Thais polyxena* (Plate II., Fig. 7) from the marshes of the Austrian Danube, though the one

plant is about as unlike the other as might well be imagined.

The transmission of large larvæ by post is a somewhat delicate matter, especially when it implies a journey to or from the Continent. Young larvæ can be packed in the tubes or metal boxes already described. But when more developed, tin boxes, with the sides " mudded " with wet earth and allowed to dry, or packed with twigs of the food plant, sufficient to give the traveller a firm foothold, are the best. The lids, also, should be perforated for air, and in winter the parcel should be swathed in warm wrappings, for I have received larvæ from the Riviera in March and April which never recovered their first (and last) experience of the British spring.

With the majority of insects which pupate above ground in the spring and summer months, all that is necessary is to leave the pupa alone in a *shady* place, remembering that exposure to the sun's rays is fatal in most cases. Suspended pupæ especially should remain " in position " at all seasons ; otherwise cripples will preponderate when emergence takes place. Pupæ attached to the stems of plants, etc., should also be carefully treated. If necessary, cut off the stem or twig, and pin up in the breeding-house, so that the pupa is in its natural position. With burrowing larvæ, if possible leave the earth or sand wholly undisturbed, and keep damp (not wet) by placing on the surface moss which has first been boiled to destroy all insect life contained.

Some collectors rear their larvæ in perforated zinc-bottomed boxes or cages, and the soil may then be treated by placing underneath a shallow dish filled with water. With loose pupæ—that is to say, neither attached nor subterraneous—the humid conditions of the air may be reproduced with a water spray-syringe such as is used for

toilet perfumes. Otherwise, where the period of pupation is prolonged, the pupa case becomes so dry and hard that the would-be imago is unable to get out of it at the appointed time.

It should also be borne in mind that a certain number of species—apparently those which develop late in the pupa—continue in the pupal stage more than one year ; some, like the " Small Eggar," *Lachneïs lanestris*, have been known to " hold over " before emergence six or seven years, and to my knowledge the " Belted Beauty," *Nyssia zonaria*, two and even three, the apparent reason being unfavourable weather at the normal moment of emergence. While, again, larvæ of certain species remain quiescent over a similar prolonged period, saving up, as it were, in case the immediate generation is destined to fail—a characteristic specially notable in those insects which are double or triple-brooded, the larvæ of the normal first emergence holding over to the first of the following year.

For postal purposes, pupæ should be packed in strong boxes between layers of wool, but never when there is any chance of the species emerging on the way, as travelling in summer it has sometimes happened that butterflies have made their appearance actually in the train, and, naturally, deprived of the necessary space and light for the full development of their wings, the results have been disastrous.

While on the subject of packing for post, I may also suggest that the greatest care be taken with pinned moths and butterflies if they are to arrive safely at their destination. Postal boxes, cork lined and cork covered, are sold in many sizes ; but any box with a cork lining will do, provided a sufficiency of cotton-wool is wound round it. My own rule is to enclose the box which contains the insects in another larger one—tin for preference—and pack in with wool,

shavings, etc. I then wrap the two in a cylinder of "corrugated" cardboard, as used for bottles, also packed with wool, and tie up the whole in brown paper, writing the name and address on the outside, as well as on a label attached in such a way that the postmaster, in cancelling the stamps, does not administer a jarring shock, smashing antennæ, and snapping bodies and legs! As a further precaution the insects may be pinned into the cork through a thin layer of cotton-wool, which will thus act as a gentle support to the fragile contents.

CHAPTER V

THE PERFECT INSECT—KILLING—SETTING—STORING

AFTER capture in the field, or successful emergence in the breeding-cage, our next consideration is the most effectual means for preserving butterfly and moth. I need hardly say that the utmost care and deftness is necessary to maintain specimens in their natural perfection and beauty; and, by reason of the frail nature of the wing scales or "feathers," and the transient quality of their pigment, it is the exception, and not the rule, to catch "wild" butterflies and moths in ideal condition. For this purpose we must be on the spot at the time when an emergence is actually in progress, since it is astonishing how soon butterflies especially become faded, torn, and worn. In the mountains a prolonged storm will do for a species altogether, while the activities of several sunny days' fighting, drinking, and love-making, which sums up the *raison d'être* of the male existence at least, quickly reduces the more delicately fashioned to rags, in which condition, however rare, they should not be taken home, unless it be the case of a live female likely to lay eggs in captivity. Insects, also, when beset, occasionally have an annoying habit of sheltering headlong in the thickest furze bushes, with fatal results to their appearance.

Some of our most successful collectors despatch their captures with a pinch beneath the thorax. But it requires exceptional skill and long practice to perform the operation without damage to a small subject, and to ensure quick and

certain death; and of course, the process is only possible with butterflies, Geometrid and other *thin-bodied* moths. To attempt nipping the solid, stout Noctuids is to court the utter destruction of the moth for the cabinet; and is as barbarous a method almost as sticking a pin through the living creature, and leaving it to die—it may be after days—in the collecting-tin.

For home work the favourite, and perhaps the quickest method in the long run, is to stupefy the victim with an anæsthetic, and then inject oxalic acid at the juncture of the wings with the body. This plan is absolutely effective, and wings themselves, treated in this way, retain their natural slackness for a considerable length of time, if kept in a cool place, which, as we shall see presently, is essential. The killing-bottle should be wide-mouthed, of convenient size to hold the larger moths or butterflies, and charged either with cyanide of potassium overlaid at the bottom of the glass with plaster of Paris, or the cork stopper should be lined inside with cotton-wool or flannel, upon which from time to time may be spurted a few drops of chloroform. When the insect is thus rendered quite unconscious, it may be tipped out of the bottle, and the *coup de grâce* delivered with a (used) steel pen dipped in a saturated solution of oxalic acid, or, better still, with a syringe, the latter made by drawing out to a fine point and breaking off a piece of thin glass-tubing the broad end furnished with a little rubber ball or an ordinary piece of rubber tube tied on with wire to make it air-tight and act as a pump.

My own plan for dealing with captured insects, however, is quite different. Every butterfly or moth taken by day or night is placed in a *glass-bottomed* pill-box, and these can be procured from the dealers "nested" from the smallest familiar size to such as will contain the

largest species. These are carried in a satchel, which if possible should be so divided that as each box receives a tenant it can be separated from the "empties." Better still, the collector should wear a coat after the fashion of the shooting-jacket, with spacious pockets both inside and out—"rabbit pockets" I think those which run round the lower part are called. He will then be independent of bag or satchel altogether—no small consideration when the hunting ground is on our sweltering chalk downs, or amid the sunburnt mountain pastures of Alps or Pyrenees. And the great merit of the glass-bottomed box is this: the captor can inspect his treasures and decide at leisure whether they are worth keeping—a decision by no means easy with the butterfly in the net, still less so when moths are taken in the dark, or from the flower heads frequented at dusk and daybreak.

Selections having been made, on returning to head-quarters the whole of the boxes are transferred to a large tin (one of the bigger commercial biscuit-tins will do admirably), into which is introduced some small vessel containing a little strong liquid ammonia. They can then be left for the night, and in the morning all will be ready to begin "setting," the ammonia, again, tending to keep wings from stiffening for some time; or, if the next important business cannot be taken in hand at once, the boxes may be emptied, and the insects transferred to one of Newman's chemical relaxing-tins, which will keep them in a state of natural pliancy for weeks together without damage from fungus. Six pennyworth of liquid ammonia will last most collectors as many weeks; six pennyworth of oxalic acid in crystals a year at least.

Many collectors—and where collecting is done on a grand scale and in remote countries it is the only possible

method of packing—slip each specimen into a triangular paper envelope, the wings folded over the back, and the antennæ in advance of the head. But it is the common experience of all of us who have packed or obtained specimens in papers that breakages are many; and, unless set within a very short time, the wings, especially those of the "Blues," lose much of their luminous brilliance in the subsequent process of relaxation, of which I shall speak presently. To the collector who is not in a hurry, or otherwise precluded from following the ordinary procedure, I should say, "set out your insects every morning before breakfast, or when you return from the chase in the afternoon"; or, failing this, "arrange your insects, *pinned* in boxes, in such a way that relaxing them will be easiest—that is to say, with the wings expanded, not folded."

By "setting" I mean arranging the specimens to qualify them for the cabinet; and for this purpose it will be necessary to use properly constructed boards. But first, with regard to pinning. There are two fashions (unfortunately, for it suggests the inconvenience of a broad and narrow gauge railway necessitating changes!)—(*i.*) the British; (*ii.*) the Continental; and I fear it is useless urging collectors to adopt the latter in view of the fact that nearly every British, *i.e.*, purely insular, collector, will have nothing to say to it. The pin, which is best black enamelled, and of a size suitable to the specimen, should be thrust through the centre of the thorax so that it stands exactly at a right angle to the body. Black entomological pins, to be had of Natural History dealers, are preferable to white, because they do not verdigris so easily, and are less conspicuous. The insect, which should only be manipulated with a forceps, especially when the pin is of extra fine quality, is then transferred to the setting-board; and here I should like to express my strong

dislike of the old-fashioned saddle-shaped boards, covered with paper, which are still upon the market. The objection to them is twofold: they give a droop to the wings, no more natural than the flat-setting on *flat* boards, and often allow them to touch the bottom of the drawer or store-box; thus giving the mites, which are the terror and pest of the museum, a better chance to get at their prey, if once they have effected an entry. For strange though it may seem these same mites are alleged to have an aversion to pin climbing, and seldom, therefore, attack insects "set high" which consists in driving a very fine needle-like pin (with an abominable point) through the thorax, and bringing the insect up towards the head about three-quarters of the way. Again, especially when it comes to setting small insects, the pin-holes on a much-used papered board cause such irregularities of the surface that the always delicate operation of pushing up the wings into place is rendered doubly dangerous, and sometimes impossible. The best boards, in my opinion, are those mounted with plain, unpapered soft cork, grooved in the centre to a sufficient depth to allow plenty of space afterwards between the body of the subject and the bottom of the store-box.

Having inserted the body of the insect in the groove, so that the pin stands straight up, the next thing is to adjust the wings on either side symmetrically; and to avoid the almost universal slovenliness and to ensure uniformity in this respect, a good rule of thumb is to raise the fore wings of every specimen with a needle, or bristle, until the inner margins (*see* illustration, Fig. 7, chap. ii., p. 25) are precisely at a right angle to the body, thus— —⊕— . The wings may then be secured in their places by small triangles of stiff paper, or thin cardboard, and, lastly, strapped to the board with strips of paper, two to each wing; great care

being used to ensure that the hind wings also are brought up symmetrically, as shown in the figure, while the antennæ, as far as possible, should always be arranged in the same relationship to the head.

Another method of strapping is with lengths of tracing paper drawn down each side of the groove, and the wings being placed in position beneath them, pinned down as each insect is finished—a plan much to be recommended as enabling the operator to detect slipping or displacement, after setting, as will sometimes happen, especially when the subject has been relaxed artificially. Others, again, adjust the wings by means of four parallel threads of cotton held in place by end pins, and pins at regular intervals all down the series; a method good for very small moths, but requiring excessively careful manipulation. The "Continental," which is the rule of the National Collections at South Kensington, and of all the great museums of the world besides, requires special apparatus, and under the circumstances no more need be said of it here, except that, for travelling collectors who wish to set their captures on the spot, it is well-nigh impossible on the score of baggage room.

Let your butterflies and moths remain on the boards as long as you have room for them there. The longer time they are allowed for drying, the less likely will they be to "spring," or droop the wings; and for this reason, also, a watchful eye should be kept on the boards, if not fitted all together into a case to guard against dust, spiders, and mice, and marauders in the shape of zealous housemaids armed with dusters. Mice have a weakness for full-bodied fat moths—"Hawks" in particular. A little naphthaline sprinkled in the boxes or cupboards where the boards are kept, or melted on inside the corners of the boxes, will also ensure against an invasion of mites, and the objectionable little beetle, *Anthrenus*

museorum, which, also, has a taste for "dry goods." Such a fate might have befallen one of my most valued specimens, a silvery-coloured aberration of the "Small Skipper," *Adopæa flava*, from Zinal, had I not spotted a couple of legs fallen from it in the cabinet drawer. Turning up the butterfly, the operator was revealed, and I was only just in time to prevent an amputation of the wings as well.

Sometimes when travelling, and when room is limited, the setting process may be accelerated by placing the boards in a *dry* current of air exposed to the sun. I have seen also, in one of the great private French museums, set specimens transferred to an oven, baked, and thus completely dried in a few hours. Such time-saving expedients, however, are not likely to be needed at home.

Every insect, when removed from the setting board, should be carefully labelled, and as a preliminary precaution against mistakes when travelling, I run the pin through a tiny disc of paper coloured to represent each locality, marked with the date of capture. Cabinet labels may be printed or written thus :—

NEW FOREST
25 : vii. : 1911
X. Y. Z.

the capital letters being the initials of the captor ; and many collectors give to each also a consecutive number, the locality label and the number slip being stuck on the pin underneath the subject so that both can be read without disturbing it. The number refers to the general catalogue

of the collection, which may be made up in a notebook ruled in parallel lines as under :—

Number of Insect	Name	Locality	Date of Capture	Remarks

the last column leaving space for any details of the specimen which may be thought interesting, and giving the name of the captor if other than the owner.

With regard to the arrangement of insects in store-boxes, the boxes should also be numbered and labelled on the outside covers; or if in cabinets, a general label (of genera included) may be affixed on the front, thus assisting at once to find any species required.

Most beginners will prefer the store-box plan for reasons of economy. A good cabinet cannot be bought first-hand under ten and sixpence a drawer at the least, and cheaper ones are for many reasons undesirable, chiefly because they are constructed of shrinkable wood, and seldom display the perfection of workmanship essential to make them completely air-tight. Every store-box and every drawer should also contain, either in a specially arranged cell or in hardened lumps, the required quantity of naphthaline; but if by any mischance, through an omission of this precaution, or, as often happens, by the introduction of an infected specimen from some other collection, the mites appear, it will then be necessary to isolate all the specimens in this particular drawer, and place them in an air-tight box with a little carbon bisulphide, against which no living organism will long survive; the drawer also being treated with the same evil-smelling, highly poisonous, and inflammable (that is to say, in its vapour) chemical.

In damp climates and houses insects are specially subject to mould. To obviate the disastrous effects of this fungus

a few drops of carbolic acid are necessary, and I have seen cabinets in which every drawer contains a little glass receptacle for the purpose.

Lastly, there are many species which have a tendency to exude an oily substance from the body which, left to itself, quickly permeates the nervures and the wings themselves, and soon destroys their appearance. The only way to get rid of it is to dip the specimens bodily into a bath of benzine collas, and after sufficient immersion it will be found that the grease is transferred to the bath, and the insects may then be dried in a fresh current of air, the body and delicate hairs being carefully rearranged with a camel's-hair brush. Moths taken at sugar, unless they have evacuated the intoxicating liquid, and in my own experience butterflies caught on certain flowers, notably thistles and lavender, are prone to become oily. The moths should, therefore, be given time to get rid of the " sugar " before killing, and the butterflies subjected to benzine the moment the least trace of grease makes its appearance. One species, however, a beautiful spring " Ringlet " (Plate VII., Figs. 2, 3, 5) of south-eastern France, *Erebia epistygne*, appears to be almost incurable. The grease will come off in flakes in the bath ; but in a short time reasserts itself to the utter detriment of the wings.

Again, as we have seen, the wings may have slipped on the board, or have sprung, necessitating resetting ; and for this purpose the nervures and wing-attachments must be softened to permit of their being rearranged. I have not found that the " relaxing-boxes " are much good for this purpose with other than recently killed specimens. To relax old captures a shallow saucer may be filled with damp sand overlaid with a sheet of blotting-paper, and this either placed in an air-tight box, or covered over with a damp cloth. The insects are pinned on to the blotting-

paper, on which a little carbolic acid has been poured to prevent mould; and they may be left there for a number of days until sufficiently pliable. But I cannot promise with those which have been collected a very long or is it advisable to treat "Blues" to any lengthened the sand. The lovely metallic colours lose their ; the wings are frequently stained beyond remedy; unfrequently the azure is changed to a bilious green. ring pins a shorter time in the boxes or sand ficient; and soaking the body only in a will often make it soft enough in a few minutes sustain the operation. While quite impracticable for small insects, it is also possible to "stuff" the bodies of the "Hawk" moths and many Noctuids, breaking them off below the thorax, and after treatment mending them up with a pure solution of gum arabic; and broken wings, bodies, and antennæ may be doctored either in the same way, with cement, or with shellac dissolved in spirits of wine.

In the brief space at my disposal I have not attempted to deal with the question of preserving larvæ by rolling out the interior organs, and either stuffing or inflating the remaining skin. It is an extremely delicate process; but, of course, nothing adds more to the interest of a museum-collection than the association of each imago with the egg, larva, pupa, and food plant; and also the special parasites which, chiefly in the form of Ichneumon flies, infest them.

But I think I have said enough to show that, while the collector may concern himself with the living insect during the spring, summer, and autumn, if he has been diligent in capture and research, he will have plenty of material in his boxes to occupy his attention during the winter, when field-work is restricted, and few moths are on the wing.

CHAPTER VI

DISTRIBUTION—IMMIGRATION—COLONISATION

THE geographical distribution of butterflies and moths is a fascinating subject to pursue; and, to the question "where to collect?" the answer is "everywhere," for lepidopterous life in some form or other is almost universal on land. The most barren country, viewed superficially, may be the richest in insect life; the best cultivated is frequently the poorest. Thus a little knowledge of geology will prove a great assistance to the collector, while one of our first authorities, the late Henry Stainton, whose handbook on the British Tineides (Part II., p. 220) is still a standard English work on the subject, was wont to insist that every entomologist on the warpath should be accompanied by a botanist! Which, of course, means that entomology and botany in some measure depend upon one another, and that an acquaintance with trees, plants, and grasses is invaluable when choosing localities for special species. As it is, even in London, and in the smoky industrial centres of the north of England, a very remarkable fauna exists to work upon, and the changes of colour and habit taking place among the hardy moths which patronise these apparently unpromising hunting grounds, offer in themselves a perennial source of interest.

Take a typical London park. In a fine season the flower beds throughout the summer are visited by numbers

of common butterflies. The "Whites" are much in evidence, and the empty pupa cases on the walls and under the seats bear witness to their Cockney origin. With the first impulse of spring stirring in the green buds of the holly and bay trees, the bright little "Holly Blue," *Celastrina argiolus*, visits the suburban garden, while our commoner Vanessids — the "Red Admiral," the "Small Tortoise-shell," and more rarely the "Peacock"—put in an appearance about the middle or end of August, accompanied by the "Small Copper" and perhaps the "Common Blue." Autumn, too, brings with it a host of the erratic, day-flying "Vapourer" moth, *Orgyia antiqua*; in Piccadilly the electric lamps may be peopled with adventurous Noctuids; and earlier, again, the trained eye will learn to detect the dusky-winged "Brindled Beauty," *Lycia hirtaria*, clinging to the soot-begrimed tree-trunks. Even cellars and warehouses have their moth tenants; and there, appropriately enough, fed on some unsuspected cask-fungus, occasionally occurs the small, very rare, entirely black Geometer known as *Boletobia fuliginaria*. I only mention these two or three town-bred insects to show how even the largest cities may afford material for the observant entomologist.

In the North, and in less degree in London, certain moths are rapidly being transformed from white or grey to black; probably to ensure their better concealment against natural enemies. For example, within living memory, in the manufacturing districts of Yorkshire and Lancashire, and generally, I think, in very damp climates quite away from the influences thus artificially created, dark races of normally light-coloured moths are continually reported, and the phenomenon is known as melanism—meaning the tendency of species to adopt darker hues.

A converse process tending to albinism or light colours is

also observable in other areas, where the surroundings are calcareous. For example, the males of one of the loveliest of continental "Blues"—reported singly (and quite unaccountably) from Dover—*Polyommatus hylas*, from dazzling azure assumes a shining silvery white in the Spanish sierras of the South (= var. *arragonensis*), while our own "Chalk Hill Blue," *Agriades corydon*, displays a similar tendency in the hot Basses Alpes, and southwards. Albinism also occurs in many other butterflies, but in most instances the apparent "whitening" is due to a failure of the scale-pigment, as will readily be ascertained by examining "Meadow Browns," which are blotched and in some cases entirely white upon the upper sides; a less pronounced albinism of this kind also not infrequently showing itself on our larger Fritillaries—the "Silver-washed," *Dryas paphia*, and the "High Brown," *Argynnis adippe*.

To revert to the subject of distribution, the United Kingdom reproduces in miniature the conditions of the Continent. We have our northern, midland, and southern species, limited more or less strictly within their respective zones, while there are many which range over the whole islands, and are common to all three zones alike. Thus, just as the "Large Garden White," *Pieris brassicæ*, is at home upon the green shores of the Alten Fjord within a few miles of the North Cape itself, and reaches with the "Small Copper," the "Silver-studded Blue," and other butterflies right down to the Mediterranean; so we find all these insects with a similar distribution almost from John o' Groats to Land's End. British butterflies, and, in a less restricted manner, moths also, may be roughly portioned off as follows:—

(A) Universal in favourable localities.

(B) Northern zone, *i.e.*, north of a line drawn across England and Wales from the Humber to Anglesea.

(C) Midland zone, *i.e.*, south of A to a line drawn from the Thames to Severn estuaries.

(D) Southern zone, *i.e.*, south of B.

And, crossing the Channel, France might further (but quite unscientifically) be divided into zones

(E) Channel coasts to north of the Loire, and following a line drawn across France from Nantes to the Ardennes.

(F) From the Loire valley to the Pyrenees. But it is to be noted that southern species and forms come up to the Charente-Inférieure over an area curving *round* the central plateau from the Riviera.

I have purposely introduced that part of the Continent which immediately confronts our southern coasts because of the interesting affinities of our insular butterflies and moths with their neighbours, and also because the absence of many species, often common in the north of France, opens up a suggestive field for observation and speculation in the study of insect distribution. The British list may, then, be enumerated and arranged as follows, species occurring in Ireland being marked with an asterisk (Dr W. F. de Vismes Kane's " Catalogue of the Lepidoptera of Ireland ") :—

(A) i. *Hesperia malvæ* (Grizzled Skipper) to as far north as Sutherland.
ii. **Nisoniades tages* (Dingy „) „ „ Caledonian Canal.
iii. **Augiades sylvanus* (Large „) „ „ Firth of Forth.
iv. **Rumicia phlæas* (Small Copper) „ „ Caledonian Canal.
v. **Cupido minimus* (Small Blue) „ „ Caledonian Canal.
vi. **Polyommatus icarus* (Common Blue) „ „ Orkneys.
vii. *Aricia medon* (Brown Argus) to Cheviots; then var. *artaxerxes* to Aberdeen.
viii. **Plebeius argus* (Silver-studded Blue) to as far north as Caledonian Canal.
ix. **Celastrina argiolus* (Holly Blue) to as far north as Cumberland and Durham.

x. **Callophrys rubi* (Green Hairstreak) to as far north as Ross.
xi. **Bithys quercûs* (Purple Hairstreak) „ „ Ross.
xii. **Pieris brassicæ* (Large White) „ „ Shetlands.
xiii. * „ *rapæ* (Small White) „ „ Shetlands.
xiv. * „ *napi* (Green-veined White) „ „ Ross.
xv. **Euchlöe cardamines* (Orange Tip) „ „ Aberdeen.
xvi. **Gonopteryx rhamni* (Brimstone) „ „ Cheviots.
xvii. **Argynnis aglaia* (Dark Green Fritillary) to as far north as Sutherland.
xviii. **Brenthis selene* (Small Pearl-bordered Fritillary) to as far north as Ross.
xix. *Brenthis euphrosyne* (Pearl-bordered Fritillary) to as far north as Sutherland.
xx. **Melitæa aurinia* (Greasy Fritillary) to as far north as Caledonian Canal.
xxi. **Vanessa io* (Peacock): scarce above zone B.
xxii. **Aglais urticæ* (Small Tortoiseshell) to as far north as Orkneys.
xxiii. **Hipparchia semele* (Grayling) „ „ Ross.
xxiv. **Epinephele jurtina* (Meadow Brown) „ „ Sutherland.
xxv. * „ *tithonus* (Gatekeeper) „ „ Argyll.
xxvi. **Pararge egeria*, var. *egerides* (Speckled Wood) to as far north as Caledonian Canal.
xxvii. **Pararge megæra* (The Wall) to as far north as Aberdeen.
xxviii. **Aphantopus hyperanthus* (The Ringlet) to as far north as Ross.
xxix. **Cœnonympha pamphilus* (Small Heath) „ „ Shetlands.

(B) The species confined to this zone are:—

Aricia medon, var. *salmacis*, and var. *artaxerxes* (see above).
xxx. **Cœnonympha typhon* (Large Heath); var. *philoxenus*, and var. *laidion*.
xxxi. **Erebia epiphron*, var. *cassiope* (Mountain Ringlet); County Mayo in Ireland.
xxxii. *Erebia æthiops* (Scotch Argus).

(C) The species within this zone are:—

xxxiii. *Cyclopides palæmon* (Chequered Skipper).
xxxiv. *Strymon pruni* (Black Hairstreak).
xxxv. *Papilio machaon* (Swallow-tail); eastern counties only.

(C) and (D) The following species occur in these two zones :—

xxxvi. *Urbicola comma* (Silver-spotted Skipper) to as far north as Scarborough.
xxxvii. *Thymelicus acteon* (Lulworth Skipper); south-west only.
xxxviii. *Adopæa lineola* (Essex Skipper); eastern counties.
xxxix.* „ *flava* (Small Skipper) to as far north as Scarborough.
xl. *Lycæna arion* (Large Blue); Cotswolds, and western counties only.
xli. *Agriades corydon* (Chalk Hill Blue); north to Cumberland.
xlii. „ *thetis* (Azure Blue); southern counties to Chilterns.
xliii.* *Zephyrus betulæ* (Brown Hairstreak).
xliv. *Strymon w-album* (White Letter Hairstreak); occasionally north of zone C.
xlv. *Nemeobius lucina* (Duke of Burgundy Fritillary) as far north as Dumfries.
xlvi. *Aporia cratægi* (Black-veined White); Kent only.
xlvii.* *Leptosia sinapis* (Wood White).
xlviii.* *Dryas paphia* (Silver-washed Fritillary).
xlix. *Argynnis adippe* (High Brown „).
l. *Melitæa cinxia* (Glanville Fritillary); Isle of Wight only.
li. „ *athalia* (Heath „); doubtful in Ireland. D only.
lii. *Eugonia polychloros* (Large Tortoiseshell).
liii. *Polygonia c-album* (Comma); mainly in the west.
liv. *Limenitis sibylla* (White Admiral); mainly west and south.
lv. *Apatura iris* (Purple Emperor).
lvi. *Melanargia galatea* (Marbled White).

To which must be added the following species replenished by immigration from the Continent :—

lvii.* *Colias hyale* (Pale Clouded Yellow).
lviii.* „ *edusa* (Clouded Yellow).
lix.* *Pyrameis cardui* (Painted Lady).
lx.* „ *atalanta* (Red Admiral).

And such occasional visitors as :—

lxi. *Everes argiades* (Bloxworth Blue).
lxii. *Lampides bæticus* (Long-tailed Blue).

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lxiii. *Pontia daplidice* (Bath White).
lxiv. *Issoria lathonia* (Queen of Spain Fritillary); once only in Ireland, 1864.
lxv. **Euvanessa antiopa* (Camberwell Beauty).

And occurring at a comparatively recent date, but now probably extinct:—

lxvi. *Chrysophanus dispar* (Large Copper).
lxvii. *Nomiades semiargus* (Mazarine Blue).

And to these again might be added a few more species which, either authentically or doubtfully (for our oldest authors, with a generally incomplete knowledge of insects outside the British islands, were necessarily inaccurate in their identifications), occurred in the United Kingdom, among them the small chequered black-and-white "Skipper," *Hesperia alveus*, the two lovely "Coppers," *Heodes virgaureæ* (Plate VIII., Fig. 1), and *Chrysophanus hippothoë* (Plate VIII., Fig. 2), and the less striking *Loweia dorilis*; *Iphiclides podalirius* (the "Scarce Swallow-tail"), *Argynnis niobe*, and *Cœnonympha arcania*—a catalogue in itself highly suggestive, inasmuch as all the species included do actually occur at no great distance from the coasts of the Channel, the actual *alveus* reported from Norfolk being of the form of that perplexing butterfly separated and described as var. *armoricanus* (that is to say, "of Brittany") by M. Charles Oberthür of Rennes; *L. dorilis*, common to the northern departments; *C. hippothoë*, abundant in certain marshes; and *H. virgaureæ*, reported farther east from Belgium. But whether any of them ever maintained a foothold in England remains to be seen. Available evidence warrants the Scots verdict of "not proven."

The cases of the "Scarce Swallow-tail," *I. podalirius* (Plate I., Fig. 1), and the large "Fritillary," *A. niobe*, appear

to stand on firmer ground, if we may trust the French authorities who have given their attention to the matter. Across the water it would appear as though this fine "Swallow-tail" were slowly retreating southwards. A correspondent has reported it in past years in the valley of the Yeres at Eu, in the Seine-Inférieure, and actually on the sea-coast; but the northern limit appears to follow a line drawn from L'Orient in the west, north of Rennes and Evreux by Les Andelys near Rouen in the Seine valley, and just south of Amiens, to the frontier on the southern part of the department of the Nord. The alleged English localities range from Netley, Salop, to Bedford and the New Forest, and are mostly over a hundred years old. It is not impossible, therefore, and in view of the tendency of species observed in France, that *I. podalirius* was once a true British species. And if *Argynnis niobe*, reported by Giard and Paux as feeding on *Viola sabulosa* in the sand dunes of the Pas-de-Calais is dependable (M. Oberthür expresses his opinion that the so-called *niobe* is only a form of *Argynnis adippe*), then it is conceivable that the Kentish captures announced in the "seventies" are authentic, and that this splendid Fritillary made a momentary but ineffectual attempt to colonise Great Britain.

The wonder is that other species of butterflies, more or less common in these regions, do not exist in favourable localities in the south of England. Marshy woodlands similar to those of the Aisne are to be found in most of our counties; yet *C. hippothoë*, so common at Samoussy and in the marshes of the Somme, and the charming "Map" butterfly, *Araschnia levana*, are conspicuous absentees, while, though another "Skipper," *Carcharodus alceæ*, is common enough, and a strong flier, on the Breton coast at Cancale, I believe it has never been taken on our side even as a stray.

I may add, however, that diligently though the *well-*

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known haunts of certain British butterflies and moths have been hunted, and notwithstanding the encroachments of bricks and mortar, scientific farming, and other bugbears of the naturalist, there must still be sequestered spots which, in entomological parlance, have never "been worked"; and, therefore, when I speak of a species as extinct, or as a casual visitor, I do so with reservations. The "Large Copper" of the fens is admittedly "gone from our sight"; but it may be that the funeral oration over the British "Mazarine Blue" has been pronounced prematurely. At all events, I am not disposed to write the final epitaph because it has not been announced for the last four-and-twenty years. Nor will either species ever be restored to us by artificial colonisation, as has been attempted with not a few apparently likely subjects, such as *Parnassius apollo*, from the Alps (Plate II., Fig. 1), introduced into the mountains of Wales and Scotland, and *Chrysophanus dispar*, var. *rutilus*, from Hungary to the water-docks of Wicken—now in part happily secured for ever as a "preserve" for marshland birds, insects, and plants against the ravages of fen-fires, Enclosure Acts, and golf-links.

Colonisation, indeed, in the case of insects is as difficult a business as with human beings. A few species appear to take kindly enough to foreign conditions: *P. rapæ*, our "Small Cabbage White," has invaded Canada and established itself as securely as the American Water Weed in our canals and rivers; *Plusia moneta*, one of the loveliest moths of the "Gamma" tribe, within quite recent years has made itself a permanent home among us from the Continent, and is extending yearly northwards and westwards, wherever there are gardens planted with aconite and delphinium for the larva to devour. But the great majority of immigrant species fail to breed successfully under our conditions, those

which have to hibernate, or pass the winter in the larval stage, seldom surviving the humid atmosphere, and never the frosts, characteristic of our climate.

Thus we may successfully rear, and observe, the habits of Continental butterflies and moths; but when it comes to turning down the perfect insects at home to continue the species, the result invariably in my experience is failure, and another reason for that failure may be the impossibility of experimenting with sufficient numbers. Nature does everything on the grand scale, and in that mood it is useless to emulate her operations. The majority of insects, like rabbits, are protected against extinction by their extreme fertility. In Britain, where birds are encouraged, it stands to reason that insects which are not distasteful to them in the larval state could never increase and multiply in such abundance as in less " bird-haunted " regions. Yet this is but one consideration in estimating the chance of survival in a butterfly or moth reared in captivity and liberated. Conditions exist essential to the propagation of the necessary numbers, of which, apparently, we know nothing. Nor is it wholly a question of good weather or bad, suitable or unsuitable food; for " butterfly years " do not entirely coincide with records of sustained sunshine any more than rainy years are adverse to great development of moth life. It may be, also, that their natural parasites, existing in our country in overwhelming numbers, ensure the failure of the experiment from the outstart, because there is no chance even of " the fittest " surviving their attacks.

In the acclimatisation of plants the same difficulty presents itself, and as a single instance of this I may cite a recent case where roses imported into the United States from the west of France failed entirely to grow until the same parasitic and tiny creatures which keep the rose

destroyers within limits in the Loire valley were introduced and turned down to do their work of decimation in the gardens of Virginia. Unsuccessful efforts, too, have been made of late years to add to the beauty of the London Parks by the introduction of Vanessid larvæ, and of other hardy species which under favourable conditions might be acclimatised. For many reasons, and I think mainly because of the accumulation of smoke-grime on the foliage of their food plants, these colonies have come to nothing.

Elsewhere partial success only has rewarded careful *transplantation* of British or Continental closely allied species from one favourable locality to another. In the south of Ireland, for example, encouraging results were obtained by turning down larvæ of the splendid *Gonopteryx cleopatra*, the glorified first cousin of our common "Brimstone," *G. rhamni* (Plate III., Fig. 1), which is abundant in the south of France, and, with its chrome wings, heavily blotched with vermilion, attracts even the un-entomological eye as it swings lazily over the valerian-bowered rocks at Hyères, or flashes among the oak woods of the Eastern Pyrenees. For two or three seasons it held its own. But after that it disappeared. Mr Christy of Emsworth, Hants., too, successfully established a colony of the yellow aberration of the common "Six-spot Burnet Moth," *Anthrocera filipendulæ* (Plate XII., Fig. 10), in that district, the form being elsewhere only of the rarest occurrence. But this was a case of transplanting British parent moths from one British locality to another, and in this direction it may be that experiments will be more satisfactory. My own experience with British as well as Continental insects is not encouraging.

CHAPTER VII

COLLECTING

In the previous chapter I said that collecting and observation might profitably be carried on everywhere; but the zone divisions (pp. 57-61) suggest that many localities are richer in species than others. For productiveness, then, I should range them in the following order: (*i.*) Those where chalk or limestone predominates; (*ii.*) fen and sand; (*iii.*) gravel; and (*iv.*) clay; though I am by no means sure that well-wooded clay lands are not the best, for Noctuid moths at all events. An abundant flora is essential; for tree-feeding species plenty of timber and shrub, though it is a well-known habit of many species—the "Purple Emperor" and the "black" Hairstreaks, for example—to choose the *poorest* undergrowth for egg-laying. With the time of year when each kind may be looked for I shall deal, as far as possible, in the Second Part of the book.

Concerning the day-fliers, that is to say all butterflies, there existed among older collectors a superstition that none indulged in flight before ten o'clock in the morning. This may, or may not, have been due to the late hours observed by naturalists of that epoch. My own experience is that no hard-and-fast line can be drawn. Butterflies are astir, as a rule, directly the sun is sufficiently warm upon them to encourage flight, and the energy of a butterfly appears to be measured wholly by the strength of the sun's

rays, to which it will always expose as much wing surface as it can. As soon as the sky is overcast it drops down into the grass, or settles upon some flower, rock, or tree-trunk, and folds its wings; while on grey days, or even when it is wet, the collector in suitable localities may make a very decent bag by examining flower-heads, grass-bents, and rushes, which are particularly affected abroad by the "Lulworth Skipper," *Thymelicus actæon*, in its alpine and mountain resorts. The "Blues" habitually roost on grass stems, and about dusk of a summer evening it is a charming spectacle—these hundreds of tiny jewelled creatures, hanging motionless, not less graceful in appearance than the flowers. Others affect the blossoms themselves, and the "Burnet Moth," which has probably been soaking honey all day, will continue his potations until the dawn. I suppose it was with the idea of taking butterflies at rest that the "ancients" invented the clap-net—a two-handled atrocity which some of our modern text-books have perpetuated in design, though I never met or heard of any entomologist who attempted collecting with this cumbrous archaic weapon.

The net itself, its size, shape, and fashion, is a matter of individual taste. The orthodox badge of the bug hunter is a green muslin bag attached to an iron ring of ample circumference, wielded on a walking stick. The ring is jointed, and made to fold up for the pocket—not only, I suspect, for portability's sake, but because, even to this day, many of us prefer to conceal our nets from inquisitive eyes when walking through towns or travelling. On the question of colour and quality opinions differ considerably. I have long since abandoned the Moslem-green net. As a rule the material is affected by rain, and fades to a dingy tone, making it extremely difficult to identify the captures within its folds.

White, though better adapted to the purpose, also gets dirty very soon, and shows every stain. To my mind, therefore, black "silk gauze" material is far and away the best for all purposes, and I strongly advise its adoption. As for the size of the bag, it is a mistake to have it too small. I know the search for small butterflies and moths in a big net rather suggests looking for a needle in a haystack; but the net which is too small requires to be worked with exceptional skill and precision, and few of us are likely "to score a bull's-eye" every shot with it. As for the handle, I prefer a stick which can be used for walking, and the ring should fit on it tightly, whether with a side screw or tubular Y. Otherwise it may happen that in striking at an insect the net may close before it is actually within.

For high-fliers a bamboo pole may be employed. But the collector will soon notice that most of the insects which circle about the tops of trees, the "Purple Emperor," the "Purple Hairstreak," and the spring "Orange Underwings," *Brephos parthenias* (Plate XVI., Fig. 8) and *B. notha*, at certain hours of the day descend to lower altitudes, or are to be wooed to them by the very simple contrivance of a sufficiently strong-smelling bait. For it is a mistake to suppose that butterflies exist upon "spirit, fire, and dew." On the contrary the "Emperor's" favourite viand is decayed animal matter, and the woodland *Pararge achine* of the Continent I know to be drawn irresistibly towards the final remains of a rabbit. Nothing, also, is more attractive to "Blues" and "Skippers" than mule and cow droppings, and at the same sort of feast I have seen a forest road in western Switzerland gorgeous with "Emperor" males and their imperial cousins, *Apatura ilia* (Plate III., Fig. 3). Their Majesties' consorts, however, seldom descend to such banquets. And this is fortunate, because otherwise it is

certain the commercial collector would have exterminated such species as the magnificent *Limenitis populi* (Plate III., Fig. 4), a near relation of the "Emperor's," which haunts the French, Swiss, and German forests, as effectively as he has many another local and rare insect. Nor are butterflies, generally speaking, to be lured by *artificial* attractions. Some of the Vanessids have a weakness for ripe fruit and exuded sap; and in the autumn it is the plum tree, or peach wall, which is visited by the roving rare "British" "Camberwell Beauty," *Euvanessa antiopa* (Plate V., Fig. 1). The "Red Admiral," *Pyrameis atalanta*, also, loves the tree-trunks "sugared" for other game. But with the night-flying moths it is different. Apart from breeding and searching by day for those at rest, when, of course, there is no difficulty in boxing them, sugar, under favourable conditions of weather, is a certain bait.

What entomologists call "sugar" is a compound; the recipes for making it are various. I believe its attractive powers were first discovered by the great naturalist Doubleday, who was a grocer, and had noticed the predilection of the Epping insect fauna for his emptied hogsheads. An easy mixture to make up [illegible] is treacle mixed with rum. Another "sugar" is made with coarse brown "moist" steeped in beer, and then flavoured further with rum or even essence of anisette. I prefer to employ the former; and it should be applied at dusk to tree-trunks at the edges of woods, and on palings; and where these are not available, as may be among the sand dunes of Lancashire and Lincolnshire, then sugar flower or grass heads. Dull, damp nights are the most favourable; moonlight with an east wind is almost hopeless. But the unexpected sometimes happens, and moths have their caprices in this respect. It will be found, also, that the visitors come in flights, while

there are species which I think can only move at the dawn, so rare are their appearances. Again, the lull before a thunder-storm, with a close atmosphere, is a specially productive time. The collector who is sugaring will, however, do well to take a companion with him. I don't think he will find a net much use. But he will want both hands to box specimens and a lantern to spot them ; so that, unless he wears the light strung round his neck, he will be much better able to work with a torch-bearer. The modern " electrics " are a luxury for this work. Most of us have to be content with the humble " bull's-eye."

This same electric lantern placed in a moth-trap is invaluable. Our forefathers rather derided the notion of collecting in this way, but by a simple contrivance—a box with a glass front and a lateral aperture and a glass back, behind which the lamp is placed, rather on the principle of the lobster-pot so far as the retention of the moths is concerned—very good results have been achieved. Of course lights of sufficient candle power near the window are excellent attractions, and with a little arrangement, and if employed in country districts where lighted windows or lamp-posts are few and far between, they will yield a remunerative harvest. In the fens a usual device is to erect a sheet on poles and illuminate it. On a good night hundreds of moths will come to rest upon the white surface, and can be transferred to the boxes without difficulty ; but *against* a white sheet it is possible also to use a net, and one may be carried. Street lamps, too, furnish abundant material, and especially winter-flying species like the " December Moth," *Pœcilocampa populi*, and the early-flying Hyberniid Geometers (*e.g.*, the "March Moth," *A. æscularia*) will often be found clinging to the glass ; and later, in May, the " Prominents " or Notodontids (Part II., p. 185).

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Most *scented* flowers attract. But one or two are pre-eminent in this respect. In March and April the golden catkins of the sallow willow, with their delicious balmy perfume, swarm with moths, chiefly the Tæniocampid-Noctuas (Part II., p. 177), which are on the wing thus early in the year. In October and November the clusters of ivy bloom, which by day have harboured all the "Red Admirals" and "Peacocks" not yet gone into hibernation, are covered with Noctuids—common fellows ordinarily, but on occasion including rarities, like *Dasycampa rubigenea*, not likely to be caught in any other way.

Then flower beds at dusk yield large numbers of Geometers; and jessamine, syringa, and the tobacco plant have each their special patrons, the last mentioned being the accredited lure in September for the splendid "Convolvulus Hawk," *Herse convolvuli;* while, if we are prospecting for species in a hitherto unexplored neighbourhood, the spider's web will sometimes afford a useful clue.

As quite two-thirds of the known moth larvæ and several of the butterfly larvæ of the United Kingdom are night-feeders, it will be necessary to search their respective food plants with the lantern, or to sweep the herbage with an extra stout cloth bag-net. By day the turning of a leaf will often reveal a sleeping larva. Others, like the "Red Admiral" and the "Small Tortoiseshell" on nettle; the "Camberwell Beauty" (abroad) on sallow or birch; the "Eggar Moth," *Lachneis lanestris*, on hawthorn; and the "Greasy Fritillary," *Melitæa aurinia*, on plantain, are gregarious in their habits, and easily betrayed therefore. But, as will be more fully explained in the next chapter, larvæ, as a rule, are so well protected by assimilating the colour or appearance of their surroundings, that often they survive the keenest human scrutiny.

CHAPTER VIII

PROTECTIVE POWERS—MIMICRY, ETC.

An introduction to the study of Lepidoptera would be incomplete without some allusion to the imitative powers displayed by a vast number of insects—if not all of them—in one or other of their various phases. We find that most larvæ, pupæ, and perfect insects adapt themselves to their immediate surroundings, and by such means contrive to elude their foes; while others exhibit what are known as "warning" colours—colours which proclaim them undesirable objects of attack as themselves capable of retaliation, or distasteful. For it has been established by observation and reasoning that groups of butterflies, which would otherwise fall certain prey to enemies in search of food, assume the appearance of *distasteful* butterflies of other genera—a phenomenon specially notable in the tropical association of Heliconine and Ithomiine species, an edible race mimicking a distasteful.

In the first stage it will be found that eggs laid singly are the most difficult to detect. Those on foliage usually approximate closely in colour to the leaf, bract, or stem on which they are placed; those on branches and twigs are normally brownish or yellowish, and not only concealed from the sight of the collector, but probably from the far more piercing vision of mice and birds. Against the furred and feathered enemy, indeed, it may be that the exquisite chiselling and grooving of the shell, invisible to our

unassisted eyes, makes assurance doubly sure by harmonising with the design of the ribs and veins of the foliage. Some eggs, on the contrary, are so conspicuous that other reasons must be sought for their colour; for example, the brilliant orange eggs of the "Orange Tip," *Euchloë cardamines* (Plate II., Fig. 3), on the stem of the cuckoo-flower, or the hedge garlic. Other eggs, again, simulate some natural defect or a disease of the tree. The nut-brown egg of the "Puss Moth," *Dicranura vinula* (Plate IX., Fig. 2), on the leaf of the poplar resembles a tiny gall or other excrescence; eggs of the "Small Tortoiseshell," *Aglais urticæ*, deposited in batches on the under side of the nettle, suggest merely a swelling of the leaf substance. And the little sea-urchin shaped eggs of the "Coppers," *Chrysophanidæ*, which are to pass through the winter, reproduce exactly the drab-ochre tint of withered herbage. Searching for eggs, therefore, is a somewhat laborious task, requiring concentration and patience, unless the eye be practised with the minutest of organisms. But a knowledge of the food plant or locality in which the desired species is known to exist will, of course, be useful in the first instance; and in winter, when the field naturalist is less occupied, searching for eggs is an interesting pursuit.

In the larval phase security is attained in the majority of cases by concealment—that is to say, by feeding only at night, and lying up in some comfortable nook or cranny until the long supper time arrives—or by the same adaptation to colour environment as we have noticed, but in a less remarkable degree, with the egg. On the other hand there are larvæ which are "plain for all folk to see"; and these rely wholly on a "terrific" aspect to protect them from molestation. The "Hawk Moths" include several excellent examples of such colours and appearance, the most

obvious, perhaps, being the larva of the "Great Elephant Hawk," *Pergesa elpenor* (Plate XX., Fig. 5*b*), with its curiously suggestive dorsal markings; while some larvæ are characterised by their unpleasing scent and flavour, or even provided with structural weapons of defence. The lovely larva of the "Swallow-tail," *Papilio machaon* (Plate I., Fig. 3*a*), emits a pungent odour of fennel: the "Puss Moth" larva, *D. vinula* (Plate IX., Fig. 2*b*), possesses not only a powerful apparatus for ejecting strong fluid acid, but also a pair of "tail-whips" with which to flick aside the too persistent ichneumon fly.

Other larvæ adopt special devices, and I think none of them is more extraordinary and ingenious than that of a West African species of moth larva, *Deilemera antinorii*, Obthr., which surrounds itself with small cocoon-like structures of silk to make itself look as though the fatal ichneumon had already done its work, and the parasites emerging from the dead body of their victim had pupated on the carcass! A hungry bird or insect in search of prey, presumably would pass over an already devoured larva. None of our British species display such singular craft and subtilty. Yet a few are almost as clever in deception—at all events to *our* eyes. The larval tenements of the "Essex Emerald," *Euchloris smaragdaria*, are coated with scraps of the food plant, and reproduce the clusters of seed heads or dead leaves. The leaf-rolling Micros so arrange their dining-rooms as to provide a double exit in case of danger; the hundreds of their tiny larvæ we see dangling on long threads are only waiting for the suspected marauder who has disturbed them to sheer off, before returning up the silken ladder to what is at once their home and restaurant!

But many larvæ escape detection by individual mimicry of their surroundings, the most familiar instance being

that of the "stick" Geometers (Part II., pp. 213, etc.), which in shape, attitude, and colour exactly reproduce the gnarled twig or stem of their food plant; while the larva of the "Pacha-with-many-Tails," *Charaxes jasius*—a North African butterfly which also haunts the Riviera and the hills of Corsica—motionless on the midrib of the arbutus leaf, with its shagreen coat, and the dorsal ring mark exactly like a little crack in the leaf itself, may be quoted as the perfection of protective mimicry in a species which, if removed from its environment, by size alone would be plainly perceptible. How often, too, the glaucous larva of the "Small Cabbage White" on the nasturtium, or the transparent green larva of the "Golden Gamma," *P. moneta*, clinging to the under side of an aconite or delphinium leaf, eludes the notice of the gardener!

Other species, again, depend for survival in this phase upon their distastefulness, or the strength of their body armature. Birds are voracious consumers of insect food; but they will hardly ever touch hirsute larvæ, of whom not a few, like those of the common "Gold Tail," *Porthesia similis* (Plate X., Fig. 4*a*), are provided with strongly irritant hairs; while others, such as those of our "Fritillaries" and Vanessids, are accoutred with spines and bristles. Then there are the wood and stem borers, whom you would imagine the safest of all in their dark galleries, from which they never emerge unless as moths. But the ichneumon can and does get at them all the same, for her egg-laying apparatus is so strong and sharp that, having located with unerring instinct the imprisoned larva, she may introduce her eggs, through the soft wood or stem-fibre, into the body of the hapless grub.

I do not know of any instances of edible larvæ mimicking distasteful larvæ in self-defence.

In the case of the pupa, it is of even greater importance

that the now helpless body should be concealed effectively, as only thereby is the existence of butterfly or moth preserved in this phase. I have enumerated a few examples of the capacity of the larva to protect itself. But with the pupa the power is increased. Normally, the exposed pupa is sensitive in a remarkable degree to the colour of the material upon, or among which, it undergoes the semi-final change. Experiments with the larvæ of the "Small Tortoiseshell" and the "Small Cabbage White" show that both species are subject to variation of tint as they pupate in specially prepared and papered or painted boxes. You get light pupæ in light surroundings, and *vice-versâ*; while in Nature we find two forms of the pupa of the "Swallow-tail Butterfly" differing greatly in colour; that of the first generation, which emerges, after autumn feeding, in the following spring, being strung up to dead stems, more or less brown to grey in colouring; that of the second generation, fed up in the summer and pupating on green stems, assuming a grass-green colour; while not infrequently the two forms will occur at the same season where the larvæ have selected different places to pupate. But the power of assimilating colour is more strongly developed in some species than others, whether as larva or pupa. Thus, it has been found that the larvæ of the common "Swallow-tail Moth," *Uropteryx sambucaria* (Plate XVIII., Fig. 2), have "various shades of black, brown, and cream at their command," but the pupæ of another common moth, the "Scalloped Hazel," *Odontopera bidentata*, "while able to conceal themselves very effectually among surroundings to which the species is accustomed, are powerless to effect any appropriate adaptation to an 'artificial' environment."[1]

[1] Miss Elizabeth Bridges, "Experiments upon the Colour-relation between Lepidopterous Larvæ and Pupæ and their Surroundings." ("Trans. Ent. Soc. Lond.," 1911, pp. 136-147.)

The texture of the pupal covering must also be considered in this connection. Thus, burrowing larvæ usually turn into brown, black, or earth-coloured pupæ with hard coats which will repel the earwigs, and carnivorous larvæ of other and predatory Orders, but are little protection, all the same, against the sharp teeth of the mice, which are sometimes extremely destructive to them. Incompletely concealed pupæ which remain above ground are mostly contained in silk-spun cocoons between leaves, which have fallen perhaps from the tree on which the larvæ fed; the protecting leaves externally giving no indication of the tenant within. But for fantastic and "horrific" developments we must go to the tropics; the larva of one butterfly, for instance, pupating in such a manner that the pupal case bears an exact resemblance to the head of a snake, and therefore to be let well alone!

The protective powers of the insect in its perfect phase are no less remarkable, the colour scheme and pattern of each species being combined, it would seem, to render them either (*a*) as conspicuous as possible—that is to say, as a warning to would-be enemies; or (*b*) as inconspicuous as possible, to ensure their safety at rest; and above all in the case of the female, whose sex-value is emphasised by the fact that in almost every genus she is vastly outnumbered by the male. Indeed, it is safe to say that for every female in a possible family there will be five males, though the disparity is not to be estimated by the scarcity of "flying" females. For, while the male is almost invariably active and easily attracted by natural and artificial sweets, the female, once she has commenced her business of egg laying, neither joins in the giddy dances of the opposite sex, nor even frequents the same localities. Take, for instance, the "Ringlets," *Erebiidæ* (Plate VII., Figs. 2-5), in Britain

confined to the north. The males love to bask upon the hot rocks, or flit backwards and forwards over the steaming mountain footpath or rock-shoot. The female, on the contrary, seldom leaves the slopes where the grasses grow upon which her future progeny is to be raised. Her duties, therefore, demand that she shall be specially protected, and though with the night-flying moths the differences of sexual colouring are often non-existent or but faintly marked, in the case of those butterflies which display "warning" colours the rule holds good. With the "Blues," though in some of them there is a pronounced tendency to imitate the male appearance as possibly a more effective means of protection, the normal female is an unobtrusive brown-winged little lady, while the ocellated and dotted grey under sides of both sexes make them difficult to see when settled with folded wings.

I have no space here to follow this fascinating subject in detail. But one or two further instances may be cited to illustrate the wonderful way in which butterflies and moths adapt themselves to their surroundings. The stock example is the "Leaf Butterfly" of Northern India, *Kallima huttoni*, Moore. Each angle of the wing, every curve, is so arranged that, when at rest, the dingy under side exactly reproduces a large dead leaf, the "tails" of the wing, closed flat upon one another, figuring for the stem, and the antennæ, folded back over the body and thus out of sight, completing the illusion. Our own "Comma Butterfly," *Polygonia c-album* (Plate IV., Fig. 6), when resting, is almost as completely concealed. The jagged edges and the under side colouring, subject to a wide variation from deep sepia to clay-brown, yellow, and gold, is exactly that of the fallen leaves in all gradations of colour. And, as if to make assurance doubly sure, the "C" mark, which has

given the "Comma" its name, recalls a crack in the dried-up surface with the light shining through it. A mimic of the same kind is the "Lappet Moth," *Gastropacha quercifolia* (Plate XXI., Fig. 1), while it goes without saying that the "Emeralds" associate themselves with the verdure of woodland and wayside. The chequered green under side of the "Orange Tip," as it comes to rest upon the cuckoo-flower, makes it extremely difficult to locate; and the habit of quickly dropping the folded fore wings below the less obvious mottled hind wings renders the Continental Satyrids (*Satyrus hermione*, Plate VII., Fig. 7), and our "Grayling," *Hipparchia semele*, well-nigh invisible on the tree trunks where they love to perch. How far, however, these protective measures appeal to other than human eyes remains a problem. At all events, it seems that birds are put off by such devices.

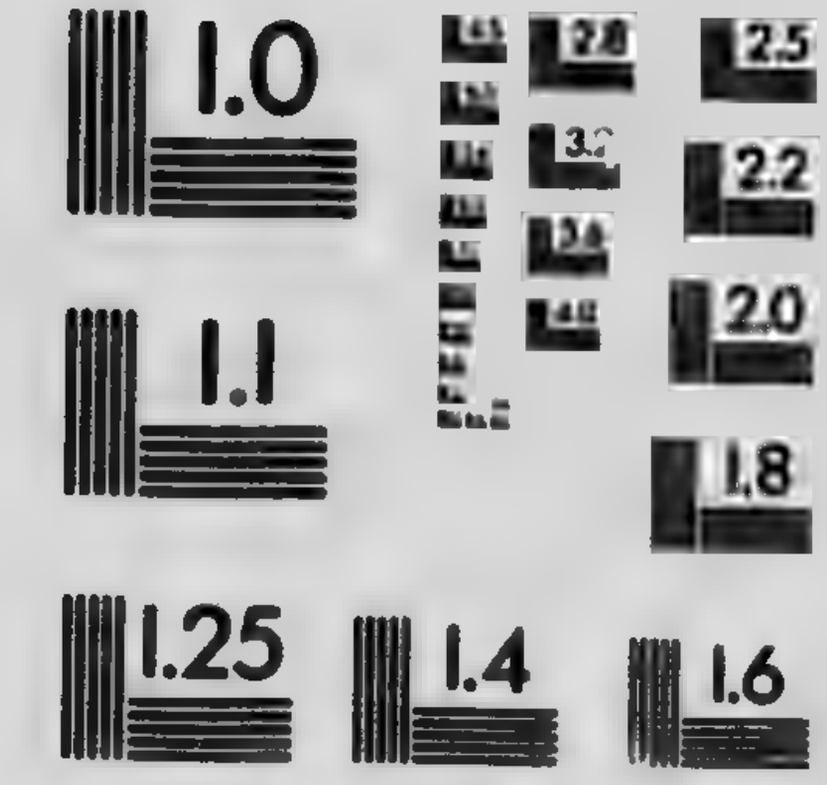
An entirely different kind of protective mimicry is exhibited by some moths, and notably the "Clearwings," *Ægeriidæ* (Part II., pp. 229-30). These, being also day-fliers, bear so strong a resemblance to stinging bees, wasps, and even hornets—*e.g.*, the "Hornet Clearwing," *Ægeria apiformis* (Plate XV., Fig. 6)—that no bird is likely to approach them, the smaller members of the group mimicking flies which are left immune for like reasons.

Lastly, in some countries, as already stated, butterflies imitate each other—that is, the edible species mimic those which are inedible or repellent by means of disagreeable body fluids or noxious odours. But in all cases the object is the same—the preservation of the species. And, with this in view, the tendency to vary, more marked in some insects than in others, indicates that the process of "natural selection" for the purpose is not advanced to finality.

In my extremely elementary treatment of mimicry and

MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



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protective resemblance, I have merely grazed a subject of profound interest in its manifold phases to the student of Nature. It presents innumerable difficulties and puzzles. But the field worker, with a first-hand knowledge of the habits of butterflies and moths in their native haunts, may reasonably look forward to throwing additional light upon the many problems advanced since Darwin first explored the origin of species and laid down the laws of natural selection, and the survival of the fittest.

PART II

PART II

DESCRIPTION OF GENERA AND SPECIES

IN this Part, which is devoted to descriptions and short life histories of British butterflies and moths and some others occurring on the Continent, the SUPER-FAMILIES are arranged in their several series, or lines of descent, as shown on p. 31, Part I. By commencing with those at the *foot* of each line, the most specialised, or structurally developed, head the list; the most generalised, or undeveloped, coming at the bottom of A, B, and C respectively. In this way I can give the butterflies, which I have treated individually at greater length than any other Super-families, their traditional place at the beginning of the series, followed by the Hesperiides or "Skippers," which constitute a remote, but none the less a connecting link between the butterflies and the moths. The series, then, and the several Super-families included in each, will be taken in the following order :—

I. A and AA	II. B	III. C
A i. Papilionides	i. Geometrides	i. Sphingides
„ ii. Hesperiides	ii. Drepanulides	ii. Saturniides
AA iii. Lymantriides	iii. Cymatophorides	iii. Endromides
„ iv. Arctiides and Lithosiides	iv. Brephides	iv. Lasciocampides
„ v. Nolides	v. Pyralides	v. Pterophorides
„ vi. Nycteolides	vi. Tineides	vi. Psychides
„ vii. Noctuides	vii. Adelides	vii. Anthrocerides
„ viii. Notodontides	viii. Eriocraniides	viii. Eucleides
A ix. Cossides		ix. Nepticulides
„ x. Tortricides		x. Micropterygides
„ xi. Zeuzerides		
„ xii. Hepialides		

A. I. SUPER-FAM. PAPILIONIDES.

FAM. NYMPHALIDÆ.

Sub-Fam. Melanargiinæ.

MELANARGIA GALATEA, L., THE "MARBLED WHITE" (Plate VI., Fig. 6).—This, the first, and one of the fairest, of our British butterflies, is not rare on flowery chalk downs and by grassy wood-sides, though it has been mercilessly over-collected, and from this, and unknown causes as well, has disappeared from many localities where it was common formerly—for example, the Chiltern Hills of Buckinghamshire. As its name implies, the wings are white, marbled with black, the under side of the hind wings with a broken yellowish antemarginal band filled with faint ocellations. The eggs are laid by the female as she flies: the larva is a grass feeder, hibernating when very small, and when full fed is usually putty-coloured, with indistinct brown markings. It pupates, apparently without any protecting cocoon, on the surface of the earth.

The extreme northern range of *galatea* is Yorkshire, and it is unknown in Ireland. But it swarms from mid-June on through July in central Europe, especially in the lower mountain regions; in the south, however, it is replaced by the larger and whiter *M. lachesis*.

Petiver, at the beginning of the eighteenth century, dubbed it the "Mourner." In France it is still the "Half Mourner"; in Germany the "Backgammon Board."

Sub-Fam. Erebiinæ.

EREBIA EPIPHRON, var. CASSIOPE, F., THE "SMALL MOUNTAIN RINGLET," is one of the butterflies to be sought for at fairly high altitudes, and as an alpine species is the sole

representative of the numerous genus *Erebia* inhabiting marsh and mountain on the Continent. So far as the United Kingdom is concerned, it is confined to Westmoreland, Cumberland, the Scottish mountains, Rannoch in the Western Highlands, and similar localities in the west of Ireland. The form *epiphron* does not occur with us; it is a butterfly of the Vosges and the German Hartz. Our var. *cassiope* has the same dark brown wings with rusty red-brown bands, which are spotted, not ocellated as in the typical *epiphron*. The eggs are laid on grasses, and, like all the Erebias, the larvæ are night feeders. But at present no one appears to have reared them successfully through the winter, probably owing to the fact that in Nature they must be covered with snow for at least five months of the year. The pupa, however, has been discovered—the wing-cases light green, the abdomen lightish drab. In the remote spots in Britain where it occurs it is on the wing in June; in the Alps it is the commonest of its genus at all sufficient elevations—from about 4,000 feet upwards to the permanent snow line.

I cannot find that it has a French name. In Germany it is the "Blackamoor"—an appellation conferred on the whole race.

EREBIA ÆTHIOPS, ESP., THE "SCOTCH ARGUS."—This larger and handsomer *Erebia* is by no means confined to Scotland, as its English name implies, for it occurs in our English northern counties, reaching down to sea level, as, for instance, at Grange-over-Sands, in Lancashire. Deep glossy brown, with a lovely bottle-blue reflection in the sun; the fore wings are broadly banded with fulvous exhibiting two or more white ocellated spots; the hind wings with the band less distinct. But in the female the fulvous is almost yellow, and the eye spots larger. It is very fond of the out-

skirts of woods, and I first saw it on the sea-shore in the grounds of Dunstaffnage Castle, Oban, on a bright August day. In the lowlands it is particularly abundant, but, like all its kind, is only on the wing when the sun is out. The yellowish egg is laid on various grasses. The larva hibernates, and when full fed is light brown with lighter markings, and two dorsal fine black lines; it pupates in the herbage unattached, and the perfect insect is about early in August.

Of the same genus there are no less than thirty-five known species in northern and central Europe. One of them, *E. medusa*, Hb. (Plate VII., Fig. 5), is common at low levels as far north-west as Rheims; *E. evias*, Godart, widespread in the Alps and Pyrenees, and down into the Spanish sierras; another, *E. ligea*, L. (*ibid.*, Fig. 3), being the "Arran Brown," once supposed to inhabit that island, but never in modern times (or perhaps any times) properly identified there.

CŒNONYMPHA TIPHON, ROTT., THE "LARGE HEATH," is essentially a northern butterfly, common on the mountains in marshy places in many parts of Scotland, in the Lake District, and along the English side of the Cheviots, and extending in the west as far south as North Shropshire, in the east to the Humber. The typical form is tawny brown, with a row of ocellated spots parallel to the hind margins of all the wings. But every locality appears to produce its own form, some of which have also been named and described by the older authors as separate species. In the extreme north, even in the Orkneys and Shetlands, we get a very pale brown — sometimes almost white — form, with hardly any spots, or none at all; this is var. *laidion*, Bork., and I first captured it on Ben Lomond. Then there is the typical *tiphon*, as described and taken in the Irish bogs and the north-east, as on Thorne Waste, near Goole; and, lastly,

the brighter mahogany-brown butterfly, with large ocellations and wide whitish fringes, usual in Westmoreland and down to Shropshire.

The straw-coloured eggs are laid on *Rhynchospora alba*, the white beak rush. The larva is extremely lively and agile, which may assist it, as Buckler suggests, to escape drowning when its haunts are inundated. It hibernates in this phase, and after feeding in the spring is bright green, with dark bluish-green dorsal line edged with pale lemon colour, and lateral yellow stripes. The pupa is much the same colour as the rush; and the perfect insect emerges early in June in the lowlands, flying until well into August in the mountains.

In France, where it is decidedly rare, and limited to a few mosses in the north-east and swampy spots in the mountains of the east, it is recorded as the "Daphnis," though I can hardly suppose this and similar classical names can be given as their "popular" names in the accepted sense of the word. In Germany it is the "Lustre-eyed Butterfly."

CŒNONYMPHA PAMPHILUS, L., THE "SMALL HEATH" (Plate VII., Fig. 8), is as common as the "Meadow Brown" in our fields and on flowery downs, first in May and June, and then from August onwards until the beginning of October. All the wings on the upper side are tawny brown, with a black spot at the apex of the fore wings; the under side fore wings, with black spot ocellated and distinct; ground colour, bright yellow-brown: hind wings, greyish-green, with yellowish central band. The eggs, first pale green, then brown, are laid on grasses, and those of the spring parents hatch out larvæ, a part of which feed up quickly and constitute a second brood, while part "hold over" and hibernate with the progeny of the second brood. When full fed they are "dark green with a darker dorsal stripe, and a

stripe along the spiracles rather lighter again; the anal points, pink"; the pupa, green, suspended from a grass blade.

In the south of France the second brood often have black marginal borders to all the wings (=ab. *lyllus*, Esp.). The "Small Heath" there, also, is called the "Procris." In Germany it is the "Crested-Grass Butterfly." The Cœnonymphas further include several common alpine species, and of the rarer members of the family the dusky *C. œdipus*, which is remarkably like the male "Ringlet," *A. hyperanthus*, on the upper side, but finely ocellated beneath with bluish spots enclosed in pale yellow rings. The very common *C. arcania* has also been associated (in legend) with our southern counties, but there is no authentic record of its being taken wild in Britain.

Sub-Fam. Epinephelinæ.

APHANTOPUS HYPERANTHUS, L., THE "RINGLET."—This sombre-looking butterfly might be mistaken for a "Meadow Brown," with its brown, almost black, wings, relieved only by two or three dark spots. But the clear light brown uniform under side, with ocellations, three on the fore wings, and five, ringed with pale yellow, on the hind wings, mark it as the "Ringlet"; though in some examples the "eyes" have lost their borders, or have disappeared altogether (=ab. *obsoleta*, Tutt). The egg has a clear and shining appearance, and is laid on various kinds of grasses. The pale wainscot-coloured larva—a night feeder—hibernates from October to March, pupating in June among matted tufts at the root of the food plant. The perfect insect emerges in July, frequenting hedges and ditches, forest glades, and shady places. It is generally distributed in England and in Ireland, and over the Border has been observed as far north as the Firth of Forth.

In France it goes by the name of the "Tristan."

EPINEPHELE TITHONUS, L., THE "GATE KEEPER."—The familiar English name suggests hedgerows and pastures, and *tithonus* is decidedly fond of such rustic surroundings, and though by no means as common as *jurtina* (being only reported from one or two localities in Scotland), it is fairly plentiful in most English and Irish counties. The male is clear orange-brown, with two ocellated spots (or one) at the apex, and a dusky margin to the fore wings: a marked "brand" of brown in the centre; the female much larger, with clear yellow-brown fore wings and lighter margins; under side hind wings yellow-brown, with yellow antemarginal band and small white dots. The whitish glistening egg is laid on various grasses, the larva, a night feeder, hibernating, and when full fed, light brown with a thin lateral white stripe and slightly hairy. The pupa much the same colour, with black spots, and suspended by the tail from a stem. The perfect insect flies in July and August.

In France it is called the "Amaryllis"; in Germany the "Marsh-Grass Butterfly"; and other English names for it are the "Hedge Eye" and the "Large Heath."

EPINEPHELE JURTINA, L., THE "MEADOW BROWN" (Plate VII., Fig. 9).—In season, from June to September, this is certainly our commonest field butterfly: the male with inconspicuous brown wings; the female adorned with a broad ochreous-yellow antemarginal band, inset at the apex with a single ocellated spot (sometimes two), the under side altogether more lively, fore wings ochre, hind wings delicate light brown, with a faint greyish-brown antemarginal band. In the south of Europe the fulvous invades nearly the whole of the fore wings in the female, making it extremely handsome (=var. *hispulla*, Hb.). In the Canaries

it is even more brilliant in appearance (=var. *fortunata*, Alph.). The egg is laid on grasses; the larvæ, green and taper with lighter lateral stripe, pupate after hibernation; the second (August) emergence being due to a certain number coming on more quickly than the majority.

In France it is called the "Myrtil"; in Germany the "Large Ox-eye"—no doubt after the ocellations on the wing of the female. Scientifically it has borne the name of *janira* for a hundred and fifty years; but latterly it was discovered that Linnæus had first described the female as a separate species, under the name of *jurtina*.

Fam. Satyridæ.

Sub-Fam. Satyrinæ.

Of the genus *Satyrus* we have no representative. The seven western continental species are mostly lovers of extreme warmth—large black and white broad-winged butterflies of which *Satyrus hermione*, L. (Plate VII., Fig. 7), may be taken as an example.

Hipparchia semele, L., the "Grayling," is the solitary British *Hipparchia*. It affects chalky downs and waste places throughout the United Kingdom in July and August; though here, again, as in the case of the "Marbled White" in the Chilterns, it tends to disappear unaccountably from its old-time haunts. Occurring abundantly in the Swiss mountains, and also in the chestnut forests of the Midi, it may be seen settling on the tree trunks to which the under side of the wings bears a close resemblance. The fore wings of the male are smoky brown, with two black spots set in ochreous yellow at the apex and below it; in the female the yellow patches are extended in an almost unbroken marginal band through both wings. The cream-coloured egg is laid in August on various grasses, and the young larva hiber-

nates. When full fed the following June it is drabbish grey-brown, with black dorsal and darker brown lateral stripes. It pupates underground—a very rare event with butterfly larvæ—and the bright chestnut-coloured pupa decidedly suggests that of a moth.

The French call it the "Rustic," the Germans the "Eagle-Brown Butterfly."

PARARGE MEGÆRA, L., THE "WALL" (Plate VII., Fig. 3), is so named from its habit of flitting about and settling on warm sunny walls, though more often preferring the hot earth. It is a butterfly which, in my experience, is becoming rare in this country, though generally distributed throughout the United Kingdom. The wings are clear fulvous in colour, with large black ocellated apical spots, the male distinguished by a heavy black median "brand," a row of smaller spots on the hind wings and transverse bands of blackish brown, the under side mottled greyish with a row of six ocellations on the hind wings.

The pearly white eggs are laid on a blade of grass. The larva, when ready for pupation, is light green, with rather darker stripes, but generally transparent; the pupa, dull green with four small abdominal white spots on each side, suspended as with the following species. The larvæ of the second brood hibernate, and the perfect insect flies first in May, and afterwards in August, though in the south of France I have taken it as late as the third week of October.

In France it is called the "Satyr"; in Germany the "Wall Fox."

PARARGE EGERIA, VAR. EGERIDES, STGR., THE "SPECKLED WOOD" (Plate VII., Fig. 4).—The type, *egeria*, L.—a much brighter fulvous form—does not occur in Britain. Our "Speckled Wood" is a decidedly sombre insect, with its speckled brown and white wings, the under side lighter, with

a purplish stain at the wing bases. Common in most woods away from the metropolitan area, it is first a spring butterfly, but there are several emergences in the year, and it may sometimes be seen on the wing in late October and even November. I have seen hundreds of them in the North Devon coverts when pheasant-shooting was in full swing. The eggs are laid on grass, the larvæ of the last brood hibernating. When full fed they are apple-green with a dark green dorsal line; but in the earlier phases more striped. The pupa, which is suspended by the tail, is of various shades of green; and by April the perfect insect is on the wing.

In France it is the "Thyrsis"; in Germany the "Butterfly of the Quaking-grass." Lewin calls *egerides* the "Enfield Eye," and Petiver the preceding species the "London Eye."

Fam. Apaturidæ.

Sub-Fam. Apaturinæ.

Apatrua iris, L., the "Purple Emperor" (Plate III., Fig. 2), fully deserves its imperial title. It is the most magnificent of British insects, and its soaring habits suggest aloofness. In common with some mortal rulers, however, its tastes are not always in keeping with its outward appearance. For his Majesty, truth to tell, has a debased fancy for decaying matter, and prefers a filthy puddle to drink from to the diamond dews. In this way he falls easy victim to the collector, and I myself have seen scores of these splendid insects (all males, for the female seldom descends from her lofty throne on the tree-tops except to lay her eggs) tumbling over one another in a forest glade to get at the droppings of mules and other animals which may have passed that way.

The wings of the male are deep brown, with transverse bars of pure white, the purple iridescence which they display in the light being absent from the female, which is, however,

a much larger and finer insect, with the white bands and spots decidedly increased in size. The egg is exactly the colour of the sallow on which it is laid ; the full-fed larva, slug shaped, but provided with two green, red-tipped horns ; the body green, with oblique yellow red-edged stripes on each side, and two parallel pinkish stripes along the back of the head. The stout green pupa is suspended by the tail on the under side of a leaf, and the perfect insect emerges in the middle of July, occurring in many southern English woods and reaching as far north as Lancashire.

In France it is called the " Great Flashing Mars," in Germany the " Lustre Butterfly," and for over two hundred years has been known to, and admired by, British naturalists.

Closely allied, but generally more common on the Continent, is the " Lesser Mars," *A. ilia*, Hb. (Plate III., Fig. 3), a double-brooded insect, haunting forests and poplar avenues, with much the same characteristic habits as *A. iris*.

LIMENITIS SIBYLLA, L., THE " WHITE ADMIRAL " (Plate III., Fig. 5), is the most graceful of British butterflies, and well deserves the encomiums of the old writers who have commented on the sweeping flight of the species. And very beautiful it is to watch the " White Admiral " sailing serenely from bramble blossom to blossom, or in some woodland glade questing the honeysuckle on which to lay its eggs. The colour of all the wings on the upper side is black-brown, with broad white bands across both wings ; the under side clear fawn-brown, with the white bands reproduced, and the wing bases suffused with silvery blue.

The green eggs are laid on the honeysuckle, the young larva, after its summer feeding, constructing winter quarters from a rolled leaf secured to the stem by threads of silk, and exactly resembling any one of the other surviving leaves.

Resuming operations in the spring, when full fed it is a very curious-looking creature (Plate III., Fig. 5*a*.)—green with a deep purplish stain above the claspers, and tufted with reddish feather-shaped spines at wide intervals. It is single-brooded, the butterfly usually appearing at the end of June. Extinct in all its former haunts near London (including Finchley, where it was abundant at the beginning of the nineteenth century), it still adorns the much-hunted New Forest and certain Sussex and Essex copses; but its natural limits, outside the eastern county and Worcestershire, are south of the Thames.

"White Admiral" appears to be a version of the older "White Admirable." In France it is known as the "Little Sylvan," its very near ally being the "Azured Sylvan," whose scientific name (*camilla*, F.), without a doubt, was originally bestowed upon the then misspelt *sibilla* herself. In Germany it is called the "Little Halcyon," and associated—quite wrongly it seems—in the same genus with ***Limenitis populi***—the "Great Halcyon" (Plate III., Fig. 4), a magnificent forest species, which is found in considerable abundance for a few days only at the end of June in the great woods of north-east France, Germany, and Switzerland.

In this group also are placed the two strikingly beautiful black and white striped butterflies, *Neptis lucilla*, F., and *N. aceris*, Esp. (Plate IV., Fig. 5), the German "Mourners," southern species not coming west of the Maritime Alps; in the case of *aceris* not west of Vienna. On the wing they may be compared roughly to small "White Admirals."

Fam. Nymphalidæ.

Sub.-Fam. Nymphalinæ.

Early systematists, disregarding, or ignorant of the widely different structure of the larvæ of their comprehensive

genus *Vanessa*, associated the whole of the "Peacocks," "Red Admirals," "Tortoiseshells," and "Painted Ladies" with a single race. More modern research has discredited this comfortable arrangement as wholly unscientific, and leaves us in no doubt that we have, as in other similarly constituted groups, representatives in Britain not of one but several genera. I shall only attempt the briefest descriptions of the majority of these familiar butterflies, as they are all figured with their larvæ, on Plates IV. and V., except *Pyrameis cardui*, the "Painted Lady."

Closely allied are the "Fritillaries," summer butterflies for the most part, and, with one or two exceptions, widely distributed. The larvæ are also characteristic—their bodies, as a rule, armoured with spines or bristly hairs, while in the perfect insect the front pair of legs is more or less unformed. Roughly speaking, the "Fritillaries" may be divided into those which display metallic or purplish markings on the under side (Argynnids), and those which are without these adornments (Melitæids.)

Of the genus *Melitæa* we have three only in the United Kingdom, which, perhaps, from the beginner's point of view, is an advantage, seeing the great difficulties experienced by even experts in separating one species from another. *Melitæa parthenie*, Bkh., is easily confused with *M. athalia* (our "Heath Fritillary"), a butterfly on the Continent of indefinite variation, about which species and its congeners, *M. varia* of the Alps and *M. aurelia*, Nick. (Plate V., Fig. 4), whole volumes have been written in the hope of making their separation less tangled. On the other hand, *M. didyma*, Ochs. (Plate V., Fig. 5), is seen to be quite distinct, while our rare *M. cinxia* is not to be mistaken for any other member of this perplexing group.

PYRAMEIS ATALANTA, L., THE "RED ADMIRAL" (Plate IV.,

Fig. 4), is a splendid and uniquely coloured species, and, with the exception of its close relative of the Canary Islands, the "Red Admiral" is the only Western butterfly distinguished by bands of scarlet upon its glossy back wings, the bright white marginal and antemarginal spots of the fore wings adding to the superb effect, while the under side, with its delicate marbling of blues and browns, is hardly less striking.

As I have said elsewhere, this butterfly is almost certainly an immigrant, the *atalanta* of our summer gardens being the offspring of May arrivals which have laid their green eggs on the nettle. The larvæ are black, with double lateral yellow stripes; but the ground colour varies to grey. The pupa, which is suspended by the tail, is greyish, with the characteristic metallic ornaments of its kind. One of the latest butterflies on the wing and generally distributed, observations and experiments with captive examples go to prove that in Nature they cannot successfully hibernate in our islands.

Also the "Admiral" in Germany, in France *atalanta* is the "Vulcan Butterfly."

PYRAMEIS CARDUI, L., THE "PAINTED LADY."—As with the last-named species, there is no doubt that this species also is regularly replenished by migration, the spring visitors spreading over our islands and becoming the parents of all fresh examples taken later in the year. For under natural conditions *cardui* produces successive broods, that of the winter, of course, being destroyed by our climate.

The "Painted Lady," with her orange-brown wings heavily marked at the apex with black, and adorned with white spots, is a handsome butterfly; the under side even more beautiful—the fore wings flushed with rosy pink, and the hind wings with an antemarginal row of blue-pupilled spots on a fawn-coloured background. The eggs

are commonly laid on thistle, but the larva will eat almost any low-lying weed, though, unlike the other Vanessids described, it is solitary in its habits. When full fed it is greyish green or black, the black dorsal line having yellow edges, with lateral lines of black and yellow; the pupa lustrous and pinkish grey. As with others of its race, it is confined to no particular locality, ranging from the high Alps to the sea level, and in England usually in its prime in August and September.

In France they have improved on the "Painted Lady," and *P. cardui* is more aptly termed the "Lovely Lady"; in Germany, the "Thistle Butterfly."

POLYGONIA C-ALBUM, L., THE "COMMA" (Plate IV., Fig. 6), is another butterfly which in England can be mistaken for no other. The angulated and deeply indented margins of its fulvous red wings are unique; the C mark on the under side of the very variable hind wings (*cp.* Part I., p. 78) is present in no other British species. It has, however, become much rarer of late years, but in all the western hop counties is still locally abundant, though it has almost, if not entirely, deserted Kent, where it formerly occurred. I have found it abundantly in the side valleys of the Wye in Monmouthshire. The eggs, which are said to hatch in confinement two days after being laid, may be found on currant and nettle, and those of the second brood on hops. The first are laid by the hibernated butterfly; the full fed larva, black dotted with red, and spinous; the pupa, suspended from the leaf of the food plant, reddish with a green tinge, and embellished with silvery sp Normally, the perfect insects are about in July, and these are the parents of the September-October brood, which is decidedly commoner on the Continent than with us. They love to settle on warm roads where moisture

is collected, or to fan their wings on the sunny side of forest trees.

In France the "Comma" is known as the "Gamma" (=γ Greek), or "Robert the Devil"; in Germany, the "Capital C," or "Hop Butterfly."

EUGONIA POLYCHLOROS, L., THE 'LARGE TORTOISESHELL" (Plate IV., Fig. 3), on a larger scale reproduces the wing markings of *A. urticæ*, but the ground colour is less "fiery," the wing bases less darkly suffused, the three black antemarginal spots of the fore wings bigger, and the blue spots in the borders decidedly less pronounced. The eggs also bear a close resemblance to those of *urticæ*, and are laid in early spring by the hibernated parent on twigs of elm and sallow. Gregarious in their habits, the larvæ are rich velvety black, with brownish dorsal colouring, striped laterally with greyish blue. The pupæ are reddish brown on the back, ornamented with golden or silvery metallic spots, and are suspended in the Vanessid manner from any convenient ledge or cornice. In some years *polychloros* is quite common, even in the metropolitan area; in others rare. It has a wide distribution on the Continent, though nothing like that of *urticæ*, and becomes decidedly scarce in the north of England, being absent entirely from Scotland and Ireland.

It is the "Large Tortoiseshell" in France; the "Large Fox" in Germany.

AGLAIS URTICÆ, L., THE "SMALL TORTOISESHELL" (Plate IV., Fig. 2) is so common an insect that it needs no detailed description here. Its range in the British Islands extends from Land's End to John o' Groat's, and in Europe from the North Cape to the Mediterranean; Arctic forms (=var. *polaris*) being duskier than the brilliant little butterflies that haunt our gardens and the heather-clad moors and mountains. The yellowish-green eggs are laid

in masses; the black shiny larvæ, with yellow markings, common in webs wherever there is an abundance of nettles; while the drab, metallic-spotted pupæ, hung by the tails in the crevices of walls, on leaves or on twigs, cluster together sometimes as though the gregarious habit survived the larval phase. *Urticæ* is one of the first butterflies to break the winter sleep, and those flying in March are the parents of a first brood emerging in June; there is a second in August, and generally a third in October.

Its obvious and popular English name is employed for it also in France; in Germany it is the "Little Fox."

EUVANESSA ANTIOPA, L., THE "CAMBERWELL BEAUTY" (Plate V., Fig. 1).—To the collector who finds himself in Camberwell nowadays, the district hardly suggests the presence of *antiopa*. Yet there is no reason to doubt that the old "Aurelians" observed and captured this fine butterfly in the then secluded retreat of city merchants, though the story that the larvæ were one year so destructive to the trees that the Vestry offered a reward for their destruction must be regarded as apocryphal. For the "Camberwell Beauty" is an immigrant—occasionally numerous, but of late years very seldom seen at the ripe fruit on the peach wall or in the orchard, where it loves to suck the sweet juices in September. The butterfly is uniformly deep chocolate on all four wings, with broad creamy borders, interiorly studded with bright blue spots, the under side, save the border, uniform black-brown; the little fiction of British "Camberwells" having white borders to assist the collector to determine the origin of his capture, and incidentally to inflate prices in the sale-rooms, being based probably on the fact that the so-called "Britishers" have hibernated, and lost their colour in the process. I have seen the large velvety spinous larvæ (Fig. 1*a*), with their bright red dorsal

marks, hanging in festoons from wayside birches in the Pyrenees, but sallow is generally accepted in captivity as well as in the higher Alps, and the lowlands, where it abounds, in most localities south of Paris.

In France it is called the "Morio"; in Germany the "Mourning Cloak."

VANESSA IO, L., THE "PEACOCK" (Plate IV., Fig. 1), with its four blue, lilac-shaded "eyes" on the brownish-red wings, is known to most of us as a garden-haunting butterfly in August and September; while the uniform black of the under side makes it almost invisible when it settles to roost. Hibernating in houses, barns, etc., it may be seen during the winter hanging motionless and torpid from the ceiling or rafters; but in Nature it is often out and about in the March sunshine, sometimes earlier, the females depositing their piles of green eggs on nettle. The black hairy larvæ are social in their habits, and pupate suspended by the tail; the pupa case grey, or greenish yellow, with metallic lustre.

The name of the "Peacock Butterfly" is common to England, France, and Germany, and though it is not found in Norway, it appears to extend in Sweden as far north as Stockholm, and to the south of Finland, while in Britain it is reported up to the Caledonian Canal.

MELITÆA AURINIA, ROTT., THE "GREASY," OR "MARSH FRITILLARY."—Why this brilliant little *Melitæa* should have been named the "Greasy Fritillary," and, worse still, the "Dish Clout," is not apparent. I suppose the washed-out appearance of the under side gave the impression; but recent authors have corrected the name to one which properly describes its love of moist places where its food plant, the devil's-bit scabious, grows, though in captivity the larva thrives on honeysuckle. It resembles that of *M. cinxia*, but

the head is black, whereas in *cinxia* it is red, and is very active when the sun strikes upon the webs in which it congregates, and passes the winter, to recommence eating in March. In early May it turns into a pale brownish pupa with rows of orange tubercles and black markings; and the sole emergence of the butterfly takes place in May and June. On the upper side it is astonishingly variable; normally, fulvous reticulated with black, the black increasing and decreasing according to the form, and the ground colour varying in intensity, as also the six bright straw-coloured or red spots along the inner margin of the hind wings.

In Ireland it is particularly plentiful; also in some parts of Scotland. England and Wales, the Lake District, South Wales, and Kent have all their characteristic forms.

I cannot find that it has a French equivalent. In Germany it is the "Speedwell Butterfly," after one of the supposed food plants of the larva; and nine separate forms of the perfect insect have received as many names at the hands of British and Continental entomologists.

MELITÆA CINXIA, L., THE "GLANVILLE FRITILLARY." —If *M. athalia* is generally scarce and local, *M. cinxia*, the "Plantain Fritillary" of Wilkes, is nowadays even more so; and it speaks well for the robustness of the species that it has survived at all in England. As with so many of our rarer insects, there is evidence that it was widely spread along the southern coast, at all events a century ago, even if the old records of inland captures, and "near London," are to be regarded as prehistoric. As it is, like the "Lulworth Skipper," it has been forced gradually into certain fastnesses, actually on the cliffs of the Isle of Wight, and so long as these remain inaccessible, or enclosed, so long will the "Glanville Fritillary" remain a British butterfly. It is, however, so very plentiful on the opposite coast, that it is rather

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remarkable, over-collecting despite, that it should be driven to such straits on this side of the Channel, where otherwise conditions are similar. As with the preceding species, the black bristly larvæ live in webs, which they occupy throughout the winter together, the yellowish eggs being laid on the narrow-leafed plantain. The hibernators feed up quickly in April and May, and pupate suspended from the under side of the plantain leaves; the pupa case light brown with reddish and black spots. The upper side of the four wings is netted and marked with black on a fulvous ground; the under side of the hind wings with a marginal spotted brown band, and an inner band of creamy yellow white. The butterfly is on the wing in its very restricted haunts in May, and a few larvæ feed up quickly to form a small autumn emergence in good summers.

In France the "Glanville Fritillary" is known by its classic name only; in Germany it is the "Ribwort Butterfly"; and its English name was given it to commemorate a certain Lady Glanville who was regarded as more or less of a lunatic because she evinced a predilection for natural history in days when such tastes were regarded as eccentric and absurd.

MELITÆA ATHALIA, ROTT., THE "HEATH FRITILLARY" (Plate V., Fig. 3).—Few collectors of the younger generation are likely to find this butterfly occurring commonly in its old haunts. The jerry-builder and the "butcher" between them have contrived to exterminate the species everywhere in the London area; while the remoter woods, where it still maintains a precarious existence, have been hunted almost to death for the species. "I found the caterpillars of this fly," wrote Wilkes a century and a half ago, "feeding on common heath in Tottenham Wood. They are of the same fearful nature as the 'Plantain Fritillary.'" And

earlier again we hear of it " pretty common in Caen Wood," Hampstead. Happily, farther west it has been allowed some sort of " law " ; and there it may be hoped it will continue to flourish. A small butterfly in England, the upper side of all the wings is fulvous, heavily netted with black ; the under side of the hind wings with marginal white lunules separated from the central arrangement of white markings by a fulvous band. The eggs are laid on the cow-wheat—*Melampyrum pratense*—when the butterfly is on the wing in June; the full-grown larvæ are heavily armoured with spines ; the ground colour black, dotted all over the body with white ; they hibernate when quite small in colonies in a silk web, feeding up in early spring, and the pupa anticipates by its markings somewhat the colour of the imago.

I cannot find that it has a French sobriquet ; its German equivalent may be translated as the " Pied White-Plantain Butterfly."

The genus *Brenthis* includes a large number of the smaller Fritillaries distinguished also by the silvery patches on the under sides, or purplish markings. About fifteen are known to occur in Europe ; one of them, *Brenthis improba*, being confined with *B. polaris* and *B. chariclea* within the Arctic Circle, and flying even in Spitzbergen. In the Swiss Alps at moderate levels *B. amathusia*, Esp. (Plate VI., Fig. 3), will be met with by the collector ; while *B. ino* (Plate VI., Fig. 1) is another familiar species, though it comes down to plains as far north at least as the forest of Samoussy in the French department of the Aisne, and generally in moist woods where its food plant, the wild raspberry, grows. The genus, indeed, appears to prefer a cold winter climate, and thrives all through the Scandinavian peninsula.

BRENTHIS EUPHROSYNE, L., THE " PEARL-BORDERED FRITILLARY " (Plate V., Fig. 7), is of much the same fulvous

colour on the upper side of the netted wings, marked with black, and is the commonest of its genus in Britain. The under side of the hind wings presents a mosaic of purplish markings, with a border of small pearls, and a large pearl inset at the centre; also two small ones among the brick-red spots near the wing bands. The pale yellow egg is placed on the dog violet in May; the full-grown larva is sooty black, with a whitish lateral stripe, and covered with spines; but at first it feeds up very slowly, actually commencing to hibernate in June, nor moving again till the young leaves of the *viola* are beginning to unfold the next year. Abroad, however, there is an August emergence, and the butterfly is very common in the clearings and upon hill sides near woods. Rare in Scotland and Ireland, it occurs in most English counties, and I used twenty years ago to take it in Middlesex not fifteen miles from the Marble Arch.

In France it is known as the "Large Silver Necklet"; in Germany as the "Wood Violet Mother-of-Pearl Butterfly."

BRENTHIS SELENE, SCHIFF., THE "SMALL PEARL-BORDERED FRITILLARY" (Plate V., Fig. 6), on the upper side bears a general resemblance to *euphrosyne*, but in the former the occasional pearl spots on the under side of the hind wings are replaced by a central band of silver spots. The eggs, which are described as of "a subdued pale yellow," are laid in June on the favourite food plant of the genus—the "dog violet"; and the larva observes pretty much the same life habit as its congener, with a very rarely developed partial emergence from quickly fed up individuals in August. The ground colour of the full-grown larva is "a velvety smoky pink"; the spiracles black, set in ovals of a pinkish tint; below them a stripe of pinkish red (Buckler); and for pupation it suspends itself head downwards on the under side of a leaf, like *euphrosyne*. But whereas the larva of the

" Large Pearl-bordered " is fond of basking in the sun, that of the " Small " prefers to rest concealed beneath the leaf. The perfect insect is on the wing in June ; and abroad there is a second brood in late July and August. Decidedly more localised than *euphrosyne*, it is the commoner of the two, however, in Scotland.

In France it is known as the " Little Silver Necklet " ; in Germany as the " Brown-spotted Mother-of-Pearl."

ARGYNNIS ADIPPE, L., THE " HIGH BROWN FRITILLARY," in appearance on the upper side closely resembles the " Dark Green Fritillary." On examination of the under side it will be found, however, that there is an extra row of small pearly spots, inset in reddish brown, between the ante-marginal and discoidal spots, while the dark green " wash " is replaced by a strong ochreous yellow-green. But, unlike *aglaia*, it has a limited range of distribution ; common enough in the New Forest and most of the woods of the southern, eastern, and midland counties ; also in the Lake District, but not penetrating beyond the Cheviots. The eggs are laid at the end of July, and the young larva, though quickly developed, does not emerge until the following spring, when it begins feeding on the dog violet, probably only by night. Full fed at the end of May, it is purplish-black, with an intermittent pale dorsal line broken by black velvety markings at the segments ; it is also covered with delicate yellow-brown spines. The pupa is attached by the tail to the under side of a leaf, and is " of a glistening pitchy-brownish blackness, the spiky tubercles golden and brilliant in colour." Like *aglaia*, *adippe* is a swift mover when once alarmed, but it has a great affection for thistle bloom, and I have seen a row of a tall species of these plants on the Chilterns literally covered with freshly emerged males, fighting one another for a place at the banquet. I have noticed, also, that when

taken direct from the flower the body of this insect has an unpleasant habit of "greasing" in the cabinet; and the same remark applies to that other thistle butterfly, the "Painted Lady."

In France the "High Brown Fritillary" is known as the "Lesser Mother-of-Pearl Butterfly"; in Germany, for short, as the "Märzveilchen Perl Mutter Vogel," otherwise the "Spring-Violet Mother-of-Pearl." And closely allied to it is *Argynnis niobe*, reported of old (*cp.* Part I., p. 61) to have established itself on the south-east coast of Kent, but nowadays omitted from even the most ambitious catalogues of British species.

ARGYNNIS AGLAIA, L., THE "DARK GREEN FRITILLARY," is so called from the handsome green, pearl-studded under side of the hind wings, hardly less magnificent in this respect than the following butterfly, *Issoria lathonia*. The upper side throughout is fulvous yellow-brown, patterned with rows of black spots and lunules; the females darker brown at the wing bases, with a tendency in alpine examples to lose the fulvous altogether, giving the insect a dark melanic appearance. It is on the wing in the South from early July onwards, flying with great speed and energy over chalk downs, and not rarely in woods also. The yellow eggs are laid on dog violet, and the larva hibernates. When full fed it is velvety black, with ochreous dorsal stripes and a row of red dots on the segments carrying a series of spines. Before pupation it spins a shelter among the leaves, in which it suspends itself by the tail. Common in many localities throughout the United Kingdom, it ranges far upon the Continent, from within the Arctic Circle to the higher pastures of Switzerland and the Pyrenees.

In France and Germany it is known as the "Large Mother-of-Pearl." In this group of Fritillaries should be included *Argynnis laodice*, Pal., known to Germans as the

"Greenish Mother-of-Pearl" (Plate VI., Fig. 5)—though as a matter of fact the pearl is represented by an irregular silver streak on the purplish-yellow under side of the hind wings. It is, however, an Asiatic species of the north-east, coming no farther west than the shores of the Baltic and eastern Hungary.

ISSORIA LATHONIA, L., THE "QUEEN OF SPAIN FRITILLARY," is at once the rarest and least "British" of all our Fritillaries. Only very rarely has it been taken in the spring—an obvious immigrant—on the south coast, the few perfect examples netted in August and September being the survivors of their progeny. Well does it merit the royal appellation. For no butterfly of the Old World exhibits such a wealth of jewelled inlay upon the under side: the apex of the fore wings studded with mother-of-pearl; the whole of the hind wings a mosaic of shining pearl markings on a delicate yellow-brown ground; the upper sides Argynnid-like in pattern, but with a greenish tinge at the wing bases. Abroad it is a common insect in the September stubble, and everywhere in the mountains and plains where there are plenty of flowers, the species, in my experience, having a decided penchant for the bloom of camomile. But I have no record of its ever having been found in any of its earlier phases in Britain.

In France and in Germany it is called the "Small Mother-of-Pearl."

DRYAS PAPHIA, L. THE "SILVER-WASHED FRITILLARY" (Plate VI., Fig. 4), is at once the largest of the Argynnids, and the under side, washed with silvery green, distinguishes it from any other species except its congener the great *D. pandora*, Schiff., of the South, and Biscayan littoral. Especially affecting bramble blossom, with its rich fulvous, almost fiery, upper side spotted and striped, it may be met with in July and August in many of our forests; for it is essentially a woodland species, in contrast to the "High

Brown" and "Dark Green" Fritillaries, which prefer open downs and heaths. The female is of a rather more sober brown-yellow and more heavily marked with black, while the ground colour of the under side of the hind wings is distinctly greener than in the male. It has also two different forms, the normal and the aberration, *valezina*, Esp., in which the fulvous has disappeared from the upper side of the wings, and is replaced by smoky black—a form common enough in the New Forest despite the continuous persecutions of collectors and dealers. The egg is laid on the trunk of some tree in the vicinity of the food plant (L. Newman), and the young larva—a night feeder—after trying a little of the leaves of the dog violet, proceeds to hibernate, commencing to feed again in early April. Full fed, it is black and velvety, with bright yellow dorsal stripes, each segment provided laterally with branching spines; and it moves rapidly backwards and forwards with a graceful sinuous motion. The pupa is suspended by the tail hooks from a slight web of spun silk, and is embellished with metallic spots.

Becoming gradually rarer northwards, it is abundant in the western counties, Wales, and Ireland, while in the lower Alps it is no uncommon sight to see hundreds of these splendid creatures fanning their wings on the bramble blossom and hemp-agrimony by the roadside.

In Huntingdonshire the woodmen call it the "Fox"; in France it is known as the "Spanish Tobacco Butterfly," from its colour; in Germany as the "Emperor's Robe."

Fam. Pieridæ.

Gonopteryx rhamni, L., the "Brimstone" (Plate III., Fig. 1), is our "angle-winged butterfly of the buckthorn," and one of the commonest hedgerow species, making its

appearance with the first warm days of February, and flying well on into June, when the eggs for the August emergence are laid upon *Rhamnus frangula*, or *Rhamnus catharticus*; for it is not double-brooded, and it is a marvel, therefore, how the butterfly, which hibernates in the perfect state, preserves itself entirely undamaged by wind and weather, "roosting," as it has been known to do, in the thick of an ivy bush or other evergreen shrub.

The male is brimstone yellow, with an orange spot at the centre of each wing; the under side uniform pale greenish; the female pale primrose-yellow, almost white; and it is a standing puzzle among collectors in the field abroad to distinguish it from the female of the gorgeous Southern *G. cleopatra*, the male of which species is adorned on the fore wings with a suffusion of deep orange colour. The egg, which is at first pale green, then yellow, is laid on the under side of the buckthorn leaf; the full-fed larva, glaucous green, with minute black dots; the pupa, bluish green, and curiously fashioned with a sharp beak, or "nose horn," in front of the head; and the wing cases, exaggerated—the whole suggesting the contour of a curled leaf. Probably no insect enjoys a longer existence as an imago.

In France and in Germany it is known as the "Citron Butterfly."

The next group of Pierine butterflies, the genus *Colias*, embraces what are known popularly as the "Clouded Yellows," two of which only are found in England, and these by virtue of their strong migratory tendencies—a peculiarity not shared by the mountain species: *C. nastes*, var. *werdandi*, Zett., Lapland; the Arctic *C. hecla*, H. S.; *C. palæno*, L., and *C. phicomone*, Esp., of the high Alps and Pyrenees; and the eastern *C. myrmidone*, Esp.; and *C. chrysotheme*, Esp., of Hungary and the Balkans.

COLIAS HYALE, L., THE "PALE CLOUDED YELLOW" (Plate II., Fig. 5).—Just as there are *edusa* years, often at long intervals, so there are *hyale* years, and then these brightly coloured butterflies abound in the clover and lucerne meadows, which, upon the Continent, are sure "draws" for them. There seems, however, an insuperable difficulty in the way of their becoming permanent residents. The larvæ (Fig. 5*b*) not only hibernate, but require to feed a little all through the winter, and a touch of frost on the food plant is fatal. Normally it resumes operations in the very early sprin and the first brood, a few of which start upon their trav northwards to provide the second brood in remoter pa· nakes its appearance about the end of April. When fu l the larva is light green, covered with bristles, which g· ıt a velvety appearance, "and having the pinkish spots in the whitish yellow line above the spiracles very distinct." The pupa is attached by the tail pad and a silk girdle thread to the stem of the food plant, the second emergence taking place in August and September, and it is principally in the latter month that it shows itself in our southern counties—Essex, Kent, and Sussex being all favourite localities. The fore wings are primrose-yellow, with broad black margins; the hind wings adorned with a saffron-coloured spot; the female lighter, almost white, and generally much larger than the male.

In France the "Pale Clouded Yellow" is called the "Sulphur"; in Germany the "Golden 8," from the shape of the saffron-coloured discal markings on the hind wings.

COLIAS EDUSA, F., THE "CLOUDED YELLOW" (Plate II., Fig. 6), is a more frequent visitor to British shores, having a much stronger and more rapid flight, so that few y pass without its being observed in one or other of our counties. While, in the great *edusa* years—1877 for example—it has

become quite one of the commonest butterflies, and I have myself seen it in the Temple Gardens and on the Embankment. The principal emergence on these occasions takes place in July and August, and sometimes a third brood is on the wing as late as the first week in November. But for the same reason, that the larva cannot endure frost and must nibble the leaves of its food plant in winter, there is no "British" spring generation, though on the Mediterranean coast *edusa* produces successive broods all the year round. The butterfly is at once distinguishable from *C. hyale* by the brilliant ochre gold ground colour of the wings, which, with the deep black border—in the female broken with yellow blotches—constitutes it quite the handsomest of the British Pierine family. There is also a pale form of the female (=ab. *pallida*, Tutt); and another form lemon-coloured (=ab. *helice*, Hb.). The egg from rose-tinted orange changes to purple, and is laid on trefoil or clover; the full-fed larva, "grass green, covered with the same sort of short bristles as *hyale*, and velvety to the eye; the line above the white spiracles, pale yellow, with a red dot on each segment." The yellowish-green pupa is tied up in the same manner as all the Pierids. In a suitable season it especially affects the railway banks which face the sun; in the Alps I have seen it careering over the glacier passes at an altitude of certainly not less than 9,000 feet—presumably on migration bent.

In France the "Clouded Yellow" is called the "Marigold"; in Germany the "Clover Butterfly"; and recently writers have broken the melancholy news to us that the name of *edusa* is misapplied to the species, that it ought to be called *hyale* after Linnæus's description, and that *hyale* is *kirbyi*; but at present the time-honoured arrangement has not been shifted to make confusion worse confounded.

LEPTOSIA SINAPIS, L., THE "WOOD WHITE," is by far the rarest of our native "Whites," though it is a very common butterfly on the Continent, and especially in the lower alpine forests. Not so many years since it occurred all round London; but it has been driven farther afield, and in some localities in Devon, Northamptonshire, and the south-west of Ireland it is fairly abundant still. With its feeble, hesitating flight and smaller contour, it is not likely to be mistaken for the ubiquitous "Cabbage," while in the United Kingdom it is very rarely double-brooded, the butterflies being limited to May and June, when they may be seen, hardly ever settling except for the purpose of laying their white eggs on vetches. The full-grown larva is "a beautiful green, with a light-yellowish spiracular line edged above with darker green"; the pupa in shape reminiscent of that of *E. cardamines*, and in this phase it passes the winter.

In France and in Germany, apparently by some error in connection with the food plant of the species, it is called the "Mustard White."

In the genus *Anthocharis* the mottled green under side is characteristic; sometimes, as in the April generation of *A. belia*, further adorned with mother-of-pearl spots on the hind wings. But these are Southern butterflies, or of the Alps.

Our nearest ally is EUCHLOË CARDAMINES, L., THE "ORANGE TIP" (Plate II., Fig. 3), the charming butterfly which comes in mid-May, and is universal in our gardens and woodlands, on downs, and in meadows where the hedge mustard invites it to lay its brilliant orange egg, or the pale cuckoo-flower, *Cardamine pratensis*, from which it draws its scientific name. The female, however, is without the characteristic flaming orange tip of the male, which in the

lovely "Aurora of Provence," *Euchloë euphenoides*, Stgr., a first spring butterfly of the Riviera, becomes intense vermilion on sulphur. But both sexes have the mottled green under side, which protects them so effectively at rest on the flowers of their choice. The larva (Fig. 3*a*), which is very easily reared in confinement, is dark green, with a white spiracular stripe. The pupa, with its sharp beak, held to the flower stalk by a pad and single thread of silk, presents a curiously grotesque appearance; and in this phase the "Orange Tip" passes the winter.

In France and in Germany it is called the "Aurora"; and it is universal in the United Kingdom as far north as Inverness.

PONTIA DAPLIDICE, L., THE "BATH WHITE."—Whether the "Bath White" is properly included in the British List is an open question. Certainly the fresh examples, rarely caught in the south of England in September, are the offspring of spring migrants who have crossed the Channel and laid their eggs on the wild mignonette, common enough on the white chalk cliffs of Kent; while others, penetrating inland, have established themselves on the Cambridge and apparently on the Somerset downs, their claim to be called the "Bath White" being based upon the evidence of a sampler, sewn by a young lady of that city about the end of the eighteenth century, on which the insect was duly figured.

On the Continent *P. daplidice* is double-brooded and common at no great distance from the Channel. The eggs resemble the internal colouring of the mignonette flower; when full fed the larva is greyish blue, striped with yellow, and somewhat hairy; the pupa, attached to the stem by a silk girdle, green and much spotted; the perfect insect on the wing rather resembles a very heavily marked "Green-

veined White," but the under side hind wings are almost entirely invaded by deep dun green—this being of a decidedly darker hue in the spring form, *bellidice*, Och., than in the summer *daplidice*.

It need hardly be said that abroad it is not known as the "Bath White." The French call it the "Marbled Green"; the Germans, the "Mignonette Butterfly."

PIERIS NAPI, L., THE "GREEN-VEINED WHITE," like the two following butterflies, is double- sometimes triple-brooded, and is almost as common; while the spring generation is even more markedly different in appearance from that of the summer. In the spring male the black apical tips of the fore wing are small and grey; in the summer, larger and black, with a pronounced black spot in the middle towards the outer margin. In the spring form the nervures are whitish grey; in the summer, with the two spots well developed on the fore wings and an inner marginal blotch. The under side varies considerably. Usually the nervures are dusky green on a white, but sometimes clear yellow, ground, but the summer brood is marked much less decidedly and when the dusky nervures are absent, or almost so, this is the var. *napææ;* the fine mountain Continental form, of which the whole upper surface of the wings is suffused with dusky scales and dove colour to canary yellow, is called var. *bryoniæ;* but it is not taken in Britain, though common enough at low altitudes in Swedish Lapland.

The yellowish-green eggs are laid on various *Cruciferæ*, hedge garlic, etc. The larva is glaucous green, lighter than that of *P. rapæ*, and without the dorsal line of yellow; and the pupa, which in size and appearance resembles that of the "Small White," shows again considerable variety in colour and marking according to surroundings. The first emergence takes place from April to June, and

a part of the resulting progeny come out in August, the rest "holding over" until the following year, and with them the pupæ formed by the second generation.

In France the "Green-veined White" is known as the "Turnip White"; in Germany as the "Butterfly of the Rape."

PIERIS RAPÆ, L., THE "SMALL WHITE" (Plate II., Fig. 4), is perhaps the commonest butterfly of the Old World, and has been r ently introduced into the New, where it is apparently m ng itself as comfortably at home as the thousand and one nationalities who have crossed the Atlantic. As with the last example, the two broods—there is sometimes a third in the south of England—show certain seasonal forms, the summer brood being generally more heavily marked with black than that of the spring. The egg is laid on cabbage, nasturtium, and even water-cress; the larva (Fig. 4*a*), green with a yellow dorsal stripe, and covered with blackish hairs, is, unfortuna ely, thereby rendered distasteful to birds, but apparently suffers heavily from ichneumons. The pupa is secured by a pad of silk at the tail and a silk girdle to the wall or plant stem chosen, and has a remarkable capacity for imitating the colour of its surroundings, especially in winter.

PI RIS BRASSICÆ, L., THE "LARGE" OR "CABBAGE WHITE," is the handsome insect which generally puts in a first appearance in our gardens when the "Small White" is already well on with the first April brood. It displays, however very marked seasonal dimorphism, the blackish apical tips of the fore wings of the male greyer in spring, and decidedly larger and more boldly accentuated in the second female generation, while the black dashes of the lower margins are also deepened and enlarged. The eggs laid in April and June on cabbage are yellowish; the larvæ, which

feed in groups of two or three, when full fed are somewhat hairy, greyish green with a yellow dorsal and lateral line; and the pupa case, like that of *A. cratægi*, is ornamented with dots and black dashes, promising wing markings on a more elaborate scale than actually is the case in the imago. The first generation of the succeeding spring will have hibernated in this phase.

APORIA CRATÆGI, L., THE "BLACK-VEINED WHITE" (Plate I., Fig. 3), is one of those butterflies which—once common near London, and actually taken on Muswell Hill—for no apparent reason have been slowly diminishing, until a few years since it was considered as extinct as the "Mazarine Blue." Fortunately, however, this is not the case; and *cratægi*, which is universally distributed on the Continent, maintains its place as a British butterfly by virtue of survival in certain remote districts on the south-east coast. The largest of the "Whites," it is met with commonly in the fields and pastures of the lower Alps, where it is often mistaken for the black-veined *P. mnemosyne*, swinging lazily from the purple heads of *centaurea* and other honey-laden blossoms. The wings in both sexes are plain white, all the nervures marked distinctly black, and a strong discoidal spot on the fore wings of the male. The female is at once separable by the generally transparent appearance.

The yellow eggs are laid on sloe, and abroad, in gardens, where the hairy larvæ (Fig. 3*a*) sometimes play havoc with the plum orchards, as they are gregarious, living in webs of white silk on the trees, in which also they pass the winter. When full fed they are of an orange-red colour, with dorsal and lateral stripes of black; and the pupa case, girdled to the stem of the food plant, suggests that the perfect insect should be spotted yellowish white, with dark margins to the wing. But these embellishments are carried no further than

this phase, the perfect insect, as I have described it, emerging in June or July.

In France the "Black-veined White" rejoices in the name of the "Gauze Butterfly"; in Germany it is known as the "Hawthorn Butterfly."

The next two tribes of *Papilionidæ*, the Thaids and Parnassids, are quite beyond the ken of the British home collector. *Thais polyxena*, Schiff. (Plate II., Fig. 7), and *T. rumina*, L., occur only in the warmer regions of Europe where the sun-loving *aristolochia* grows. The Parnassids are purely alpine, though *Parnassius apollo*, L., familiar to every mountain climber in the Alps and the Pyrenees, in Scandinavia approaches the lower levels. Stories from time to time have been circulated of its appearance in the Scottish and Welsh mountains; but even if they be not other than travellers' tales, it can only be supposed that the insects have been introduced in hopes of establishing so fine a species as a permanent resident. Colonisation of alpine insects, however, seems at present to have been little more successful than attempts to grow edelweiss in suburban gardens. The lowest flier of the Parnassius group, *P. mnemosyne*, L. (Plate II., Fig. 2), which is actually found on the lower hills of the Bouches-du-Rhône, would, in my opinion, be quite as easy a subject for experiment as *P. apollo*.

Fam. Papilionidæ.

Sub.-Fam. Papilioninæ.

Papilio machaon, L., the "Swallow-tail Butterfly" (Plate I., Fig. 3).—The magnificent size and colouring of the "Swallow-tail Butterflies" has appealed to the imagination of all ages, and I myself have seen the signet ring of a Cretan nobleman of the "Minotaur" period emblazoned with a very tolerable representation of one of the three species

which inhabit Europe. Though generally common on the Continent—and you may see *machaon* flying over the flower beds in the public gardens of Paris, as well as in the meadows, on the coast cliffs, or high up to 8,000 feet in the Alps—in Britain it is a butterfly which has been driven back, like others I have described, before the march of the cultivator. Old records locate it in Kent, Middlesex, Dorset, etc. But to-day it has retired into the fenland of Cambridgeshire and Norfolk, where, despite the keen attentions of the collector and the dealer, it is pleasant to know that it holds its own.

The fore wings are either a deep yellow or pale primrose, with a broad black antemarginal band, beyond which is a series of yellow spots; the hind wings, which are "tailed," are also yellow, with a broader black marginal band, and each division of the band is centred with metallic blue, outside it yellow lunules and a red-gold spot of large size near the anal angle. The egg has a chameleon capacity for colour change. Shortly before hatching it is almost black, and finally transparent. After consuming the shell, the young larva attacks the leaves of fennel or milk parsley. Full fed (Fig. 1*a*), in July it presents a very striking and beautiful appearance, being bright green, with black velvet rings on each segment, and the segments spotted orange. After the third month it is further provided with a fleshy process behind the head, like a pair of horns, which it can protrude and draw in, emitting a curious strong smell, probably useful as an ichneumon scare. The pupa is girdled perpendicularly to a stem, and varies in colour, as already stated (Part I., p. 76), with its surroundings—a part of the brood emerging as the second generation in August (in hot seasons probably the whole), a part "holding over" to constitute the first spring emergence the following May.

In France it is called the "Large Tail-bearer"; in

Germany, the "Swallow-tail"; and has been allowed to enjoy the name given it by Linnæus unchanged.

In western Europe there are three closely allied species of "Swallow-tail"—the "Scarce Swallow-tail," *Iphiclides podalirius*, L. (Plate I., Fig. 1), which I have already discussed as a British insect (Part I., p. 61); *P. alexanor*, Esp., a local Southern *Papilio*, chiefly differing from *machaon* by the reduction of the black on the wings, and the consequent predominance of the pale yellow ground colour; and *P. hospiton*, Gené., a butterfly peculiar to Corsica and Sardinia, and often only to be distinguished from *machaon* by the abbreviated "tails," and the much heavier black markings.

FAM. LEMONIIDÆ.

Sub-Fam. Nemeobiinæ.

HAMEARIS LUCINA, L., THE "DUKE OF BURGUNDY FRITILLARY" (Plate VII., Fig. 1).—This, the sole representative of its family (*Lemoniidæ*) in Europe, is an altogether remarkable insect in the perfect state; for in the male the fore legs have disappeared, while in the female they survive, so that we have an example, apparently, of that "*rara avis*" in the Old World—a four-legged butterfly. This and other structural facts connected with its several phases have caused *lucina* to be shifted about continually in the whirl of classification; while, for the further confusion of beginners, by reason of its superficial resemblance to the Fritillaries, it was called the "Duke of Burgundy Fritillary" by the genius who evolved the British nomenclature, whereas it has nothing to do with the *Argynnidæ*.

The ground colour of all the wings on the upper side is darkish brown, with three lines, more or less pronounced, of ochre-yellow spots; on the under side the fore wings are lighter, with faint black transverse rows of spots; the hind

wings, ornamented with two similar rows of large whitish spots. The sexes are distinguished by the (usually) smaller size of the male, the narrower and more pointed fore wings.

The transparent globe-shaped egg is laid on leaves of primrose and cowslip. The full-fed larva (Fig. 6*a*) is very hairy—the colour of the skin, purplish, of the hairs, light brown; it feeds up through the summer, and, attaching itself by the tail to a small pad of silk spun on the under side of a leaf, passes the winter as a pupa. The perfect insect flies in late May and June, and though reported to be double-brooded on the Continent, I know of no modern instance of a second emergence here in England. Unknown in Scotland and Ireland, it is not uncommon in the woods of most midland and southern counties, but often overlooked by reason of its inconspicuous appearance.

In France it is called "La Lucine"; in Germany, presumably from the shape of the spots, the "Brown Dice Butterfly."

Fam. Ruralidæ.

Sub-Fam. Lycæninæ—Blues, Hairstreaks, and Coppers.

Lycæna arion, L., the "Large Blue" (Plate VIII., Fig. 8).—This, the most beautiful and the largest, and now one of the rarest extant species in England, is decidedly *not* a chalk-hill "Blue," though it occurs not infrequently on limestone. It appears, indeed, to be one of the rare race which prefers granite, or other formations—at least that is my experience of this splendid insect in its Continental haunts. Not so many years ago it abounded on the wolds of Northamptonshire; now it has entirely disappeared therefrom, as also from the rock-strewn south Devon coast in the neighbourhood of Salcombe, whither it appears to have been driven by force of circumstances, though what

exactly those circumstances may be remains a mystery. Of course in its former known haunts it was zealously over-collected; but this would hardly account for its extinction everywhere, and we may assume, therefore, that there are natural forces at work in this country destructive to the "Large Blue" as to the "Mazarine Blue." At present it maintains a precarious existence in some few remote localities on the Cotswolds. In north Cornwall it may be said to be making its last stand as a British insect against the encroachments of civilisation (?). On the hill-sides of Provence, in the higher Alps, in the woods of north-east France, *arion* is, however, abundant, flying quickly over the flowery wastes or down the sun-chequered glades of the forest. The males and females are deep satiny blue, the black marginal band on the fore wings of the latter being broader, and the inner marginal row of black crescent-arranged spots much more heavily accentuated. And in the Alps the black sometimes pervades the whole wings, giving a singularly "electric" appearance to the butterfly; the blue ground colour, as it were, showing through the dusky over-cloud. For many generations it has been the ambition of naturalists to unravel the life history of the "Large Blue." But until it was discovered that the larva (Fig. 8*a*) actually disappeared below ground during a large portion of its existence and became a member of the ant community, all attempts failed of success. In its earlier phases it feeds upon the flowers of the wild thyme, which it imitates in general colour; but it is still unknown upon what it feeds in the ant colony, under whose fostering care it lives for close on ten months. Mr F. W. Frohawk who first discovered the subterranean larva, thinks, however, "there is but little doubt that the food is tendered by the ants in the same way as their own larvæ are fed—from mouth to mouth

with the food the ants disgorge." The pupa, apparently, is also entertained by the same host, and changes near the surface of the soil, the perfect butterfly emerging in the first weeks of June.

In France the scientific name is adopted for it colloquially; in Germany it is sometimes called also the "Black-speckled Blue"; and *arion* it has remained since the time of Linnæus.

Closely allied to this species are the two butterflies, *Lycæna arcas*, Rott., and *L. euphemus*, Hb., both more or less marsh-loving insects, and very local in western Europe. While the third, *L. alcon*, F., a "Blue" of the mountains and the plains, is only occasionally met with—most frequently, perhaps, at the higher altitudes of Switzerland, though the larger, brighter form may be found at Biarritz and on other heaths of the south-west.

ARICIA MEDON, ESP., THE "BROWN ARGUS," resembles superficially the typical female of the "Common Blue," and is one of the family which presents the same appearance more or less in both sexes. The wings on the upper side are of a warm brown colour, with rows of bright orange-red spots at the borders; the under sides are clear greyish yellow, the orange spots reproduced, with an inner sickle-shaped row of black spots ocellated with white. In the north of England (Durham) the form *salmacis*, Stephens, occurs—the fore wings without the orange marginal spots, or nearly so; while farther north, again, *medon* is superseded by the variety *artaxerxes*, F., which has the discal spot on the fore wings white and the spots on the under side of both wings also white—a form which, so far as I can determine, is limited to Scotland. The egg is rather the colour of a leaf of the rock-rose, on which the larva feeds. The butterfly being double-brooded, the young larva of the autumn generation hibernates, and when full fed is pale green, with pink lateral

markings, and rather hairy. The pupa is fixed in a perpendicular position by silken threads holding together the leaves of the food plant. A down and heath species, the "Brown Argus" in England revels in the sunniest situations—the first emergence taking place in May, or even earlier, the second about the first week of July. The form *artaxerxes* is common where it occurs, whether in Aberdeenshire or in the green lowlands.

In France it is also called the "Brown Argus"; in Germany by the oddly inappropriate name of the "Fire Blue." Our British authors have dubbed it variously, after the German, *astrarche* and *agestis*, but Esper's *medon* appears entitled to rank by priority.

POLYOMMATUS ICARUS, ROTT., THE "COMMON BLUE" (Plate VIII., Fig. 4).—Probably no "Blue" is more familiar to British collectors than the "Common Blue," though there are countries within the wide range of its distribution where it is anything but as common as some others of its race. I have found it equally at home in the region of the North Cape, on the marshy mountains of Lapland, on the sun-kissed hills of Provence, and in the English garden. But its wide range implies also a great tendency (in the female) to vary, though I cannot find that any of the aberrations thus presented are confined to one special locality. The upper side of the wings in the male is of a shiny lilac-blue, with a narrow black border and snow-white fringe; on the under side dun grey, with rows of orange lunules towards the outer margin of the wings and antemarginal rows of black spots. The typical female is warm brown, with a dusting of lilac-blue scales at the wing bases; and there is a general tendency for these to spread, until sometimes they invade the whole area to the orange lunule borders, examples from Scotland and Lapland being the most marked in this respect, while

Southern "plain" races are often without the over-blue altogether. Indeed, a whole volume might be written on the variations of this common species. The eggs are laid on the bird's-foot trefoil. The full-fed larva, after successive moults tending to darker hue, is dull green, with yellowish markings on each side of the back; it forms a slight cocoon by drawing together two or three leaflets, but the progeny of the last autumn brood hibernate as larvæ, spinning up at the end of March; and from April onwards until the end of October in warm seasons the perfect insect is on the wing.

In France it is called the "Blue Argus"; in Germany, the "Rest Harrow Blue." Authors have christened it from time to time *argus*, *alexis*, and other names; but *icarus* apparently is the first, and therefore the decisive, name for the "Common Blue."

The genus *Polyommatus*, until recently reclassified, was made to contain a number of Continental and especially alpine species—viz., *eumedon*, *orion* (Plate VIII., Fig. 5), and *donzelii*; *damon* (Plate VIII., Fig. 7), *hylas*, *escheri*, *eros*, *orbitulus*, *pheretes*, and *optilete*—all of them to be found at the tourist mountain resorts of Switzerland, and the capture and observation of which will lend additional interest to a summer holiday; also the rarer *dolus*, *meleager* (perhaps the most striking in both sexes of all the Old World "Blues" of the West), and *baton*.

AGRIADES CORYDON, PODA, THE "CHALK-HILL BLUE," is hardly less beautiful than *A. thetis*, to which it is so nearly allied, while enjoying a decidedly wider distribution in England south of Lincolnshire; but in Scotland and Ireland it is entirely wanting. Nor is it confined to the chalk downs and heaths, being occasionally found on other formations, as, for example, at Hastings and near Oxford. The male on the upper side is silvery chalky blue, with deep

black borders to the fore wings, the English race showing in this respect a marked difference from the Continental. The female is generally warm dark brown, but both on the upper and under side tends to vary indefinitely, sometimes assuming the blue of the male over three-fourths of the wing area (=ab. *tithonus*, Meig.)—excessively rare in this country, but occasionally, as in Charente-Inférieure, outnumbering the typical form—sometimes only with the hind wings on the upper side suffused with blue (=*semisyngrapha*, Tutt). The under side of the wings of the male is chalky white, chequered and spotted with numerous blackish ocellations and a row of faint orange lunules at the lower margin of the hind wings —more pronounced in the female, in which the ground colour is deep brown. The greenish-white eggs are laid on leaves of *Hippocrepis comosa*, rock-rose, and other allied plants, late in August and September; the larva emerges in the early spring, and when full fed bears a very near resemblance to that of *thetis*, except that, perhaps, it is of a somewhat lighter green. It pupates on the surface of the earth among the stems of the food plant. In the extreme South—along the Riviera, for example—this butterfly is double-brooded, and in April haunts low-lying heaths at no great distance from the sea.

In France it is known as the "Mother-of-Pearl Argus"; in Germany as the "Silver Blue"; and except that Poda spelt "*corydon*" "*coridon*" when he named the species, the synonymic history of this "Blue" is quite remarkably uneventful.

AGRIADES THETIS, ROTT., THE "AZURE BLUE," is closely allied to the "Chalk-hill," and together they are undoubtedly the most attractive of all our "Blues." The males, with their lovely celestial or silky-blue fore wings, and the dusky females, often in the first brood suffused with the

male coloration, are familiar upon our southern and midland chalk downs; while in the mountains of central Europe they swarm, perhaps the most beautiful form of the female yet observed being that of south-western France (=ab. *cælestis*, Obthr.), in which the azure invades the whole wing surface on the upper side. At rest on a blade of grass the dark grey under side, with the rows of spots and the metallic powdering of the wing bases and edging of orange lunules, is hardly less striking. But to the unpractised eye, apart from the fact that the two species seldom overlap in the time of their appearance, the separation of the female *thetis* from the female *corydon* is something of a puzzle. Perhaps the best test is the depth of the ground colour, especially of the fringes, which in *thetis* is greyish, in *corydon*, white. In Britain there is a double emergence of *thetis*—the first in early June, the second in September; *corydon*, on the other hand, has but one brood, generally intermediate between these.

The whitish-green eggs, which bear a close resemblance to particles of chalk, are laid on the under side of a leaf of *Hippocrepis comosa*. The larvæ of the second emergence hibernate, and when full fed are deep green, covered with small black specks, with yellow stripes; and in this phase also closely resemble the larvæ of the "Chalk-hill Blue"; but at the time when the larva of *thetis* is full grown, that of *corydon* is still small, so that for practical purposes the season will decide identity. In Nature pupation takes place in the matted roots and stems of the food plant, just under the ground surface, and the ant habit is strong in both phases.

In France and in Germany the "Azure Blue" is known as the "Celestial Blue Argus." Scientific grubbing has discovered that the oldest name for it is *thetis;* but in view of the extreme beauty of the insect, it is a legitimate

cause for regret that it is now dissociated from the more characteristic *adonis*, as used by so many authors, or the hardly less expressive *bellargus*; for the "*beautiful* argus" it is unquestionably.

NOMIADES SEMIARGUS, ROTT., THE "MAZARINE BLUE."—This beautiful "Blue," which is well named the "Mazarine Blue," is probably extinct in our country, where it never seems to have been really common. Abroad, and especially in the Alps, it is one of the common species: the males "mazarine" on the upper wings, with dazzling white edges; the females, black to blackish-brown; both fawn-grey on the under side, distinctly spotted towards the margin of the fore and hind wings with black, white-framed ocellations. Why the species should have disappeared is one of those mysteries which present themselves often enough in considering the effect of our climate and our field culture on living creatures. But unless it survives in some sequestered spots, as suggested elsewhere (Part I., p. 63), I fear the English "Mazarine" is to be sought nowadays only in the museum and the sale-room. The reticulations of the egg are described as "resembling white-frosted glass, reflecting the beautiful pale blue-green ground colour of the egg" (Frohawk). Like that of *C. minimus*, the young larva bores into flower heads, and affects much the same plants; it is when full fed a vivid dark green, the skin very transparent. In confinement the pupa hangs by the tail in a thin silk cocoon spun among the food plant; and the butterfly is double-brooded on the Continent in the plains—first appearing in May, and then at the end of July.

It does not seem to have attracted a distinctive French name, but in Germany the text-books describe it as the "Half Argus"; and it enjoys the distinction at home of being noticed in one of our earliest works on Natural

History—the "*Insectorum Theatrum*" of Moufet (1634), and eighty years later by Ray. A large number of our authors have also treated it under the name of *acis*, Schiff.

PLEBEIUS ARGUS, L., THE "SILVER-STUDDED BLUE." —(Plate VIII. Fig. 3). No "Blue" has worried the collector abroad more than this, owing to a certain resemblance to another "Blue," *P. argyrognomon*, Bgstr., the confusion being made worse confounded, as it seems very doubtful whether Linnæus originally described under the name of *argus* the butterfly we have hitherto called *ægon*, Schiff., or this same *argyrognomon*. But in the United Kingdom, at all events, we are spared the problem altogether, since the alternative does not inhabit our islands. As for the "Silver-studded Blue," it is one of the commonest of its kind on gravel and chalk alike, but in England I think rather a heath insect, the bright blue male, with its dark border, and brown female toying in the middle days of June among the heather and ling of our commons. The under sides of both species present, also, entirely different aspects—the bluish ground colour lighter in the male, the spots smaller; in the female, the ground colour creamy brown, with strongly marked orange-and-black spots. The egg is laid from June onwards on various low-growing herbs, such as the bird's-foot trefoil; but the young larva does not make its appearance until the following March. From dirty whitish brown it gradually develops a more or less olive, striped with various shades of green; it changes in a little silken web spun among the trefoil stems, but occasionally under bark, and the larva is again one of those which derive a mysterious benefit from association with the ant. In Britain the species is single-brooded, appearing in June, becoming commoner from the Cheviots southwards.

In France, apparently, it shares with *argyrognomon* the

name of the "Violet-blue Argus"; in Germany it is known as the "Furze Butterfly" or the "Silver-spotted Small Blue"; and the confusion of the classical names given it has led to quite a heated controversy! But *argus* is the first, and therefore the final name for it.

CUPIDO MINIMUS, FUESSL., THE "SMALL BLUE," is not only the smallest of our native butterflies, but of all those found in western Europe. The male is generally dark brown to black on the upper side, sprinkled at the wing bases with metallic light blue scales; the female is much the same colour, but rather darker; the under side of both sexes being delicate French grey, with transverse rows of distinctly marked black spots, and a pronounced discoidal spot in the centre of the fore wings. The pale green egg is laid on several species of vetch and trefoil; but the woolly yellow clusters of *Anthyllis vulneraria* are the favourite habitat of the young louse-shaped larva, which burrows its way deep into the flower, feeding on the immature seed vessel. When full fed it bears a close resemblance to its surroundings, with its yellowish-grey skin lined faintly with red, and when passing the winter in this phase in a silk-spun shelter among grass, resembling nothing so much as an atom of chalk. Single-brooded in the United Kingdom, the perfect insect appears about the first week in June, and especially haunts the chalk downs of Sussex, Bucks., and Cambridgeshire, though by no means confined to this formation; on the Continent ranging, indeed, from the Arctic Circle to the Mediterranean; and in Scotland as far north as Inverness-shire.

In France it is the "Smallest Argus"; in Germany the "Brown Blue." Described by innumerable authors under the name of *alsus*, and occasionally as *minima*, it has now come to its own again both by right of priority, and as a concession to grammar.

EVERES ARGIADES, PAL., THE "BLOXWORTH BLUE," with the other "British" tailed "Blue," *Lampides bæticus*, has but a slender claim to membership of the British List. Only three examples are known to have been captured "first-hand"—two, a male and a female, on Bloxworth Heath, Dorset, and the third a few days later not far off. Since 1885, however, no one has rediscovered the species; or at least the one or two records appear unreliable. This little tailed "Blue," however, though most frail and delicate, has a marked capacity for colonisation; and abroad, as soon as the collector has learned the value of examining any "suspicious" "Blues" he may encounter, he will find it not uncommon. The male is violet to blue-grey on the upper side of all the wings; the female brown to almost ivory black, with two orange lunules above the "tail" of the hind wing; the under side ground colour rather that of the "Holly Blue," with an orange ocellated spot at the anal angle of the hind wings. In Brittany the spring brood prefers grassy meadows; the summer, heaths; while at Bordeaux I found it common in a sun-dried marsh. In recent years it has been the subject of much discussion among naturalists, and a supposed variety (=*coretas*, Och.) has since been established as a separate species.

In France it is known as the "Little Tail-bearer" (not "tale"); in Germany as the "Buckthorn Butterfly," from the fact that the larva sometimes feeds on the fruit of *Rhamnus frangula*. But though it has changed its scientific name often enough, it is now generally accepted as the *argiades*, figured and described by Pallas in 1771.

CELASTRINA ARGIOLUS., L., THE "HOLLY BLUE," is the first of the "Blues" on wing in April; and, as much at home apparently in our city squares and suburban gardens as elsewhere, during the last few years it seems to have

increased generally all over the country. Double- and sometimes even triple-brooded, this butterfly shows a very striking dimorphism: the upper side of all the wings of the male is brilliant azure; the under sides of all the wings in both sexes silvery bluish-white with inconspicuous black spots, these being sometimes wholly absent. In the female, on the other hand, the fore wings are heavily margined with black, while the two broods are of a different shade of blue, that of the late summer being of a decided lilac tinge. The delicate green eggs are laid in spring as a rule on the flowers of the holly; in late summer on the clusters of ivy bloom; though the larva will feed on many other shrubby trees. It is also much appreciated by ants, which extract a sweet fluid from the "honey gland" of its body. When full fed it is dark green, with a broad brownish stripe on the humpy back; the body covered with minute golden hairs. In confinement the pupa is suspended by the tail on the under side of an ivy leaf, or other surface; and in this phase it hibernates, the perfect butterfly occasionally appearing as early as March 20. In Scotland it is not known; in Ireland, on the contrary, it is as common and widely distributed as in England, though rare in the North.

In France it is known as the "Black-banded Argus"—rather a poor name, as it refers only to one sex; while the Linnæan name of *argiolus* has undergone few alterations.

LAMPIDES BŒTICUS, L., THE "LONG-TAILED BLUE," can only be claimed as British by courtesy. Obviously the few examples taken in this country have been importations, or immigrants, as this fragile-looking insect is a great traveller, whose normal northern breeding limit, however, appears to be the valley of the Loire in western France, and so across central Europe. All the British records of any value suggest

a Channel passage ; but as the female of *Bithys quercûs* has been sent to me for identification as *L. bæticus*, it may be as well to state that the two species are superficially totally different, while the slender, thread-like " tail " of the hind wings of the " Blue " is wholly unlike the blunt appendage of the " Hairstreak." An occasional visitor, the " Long-tailed Blue " has in some years turned up abundantly in Guernsey, feeding in the larval phase inside the pods of the bladder senna, *Colutea arborescens*. I found it flying very commonly in the market-gardens that environ Bordeaux ; and also, in August 1911, in abundance in the Charente-Inférieure round acacia, the larva, perhaps, adapting itself to the juicy green seeds.

ZEPHYRUS BETULÆ, L., THE " BROWN HAIRSTREAK," is nearly allied to the " Purple," and it is also the largest of our natives of this sub-family. But because of its protective resemblance to the foliage, etc., of the trees in its haunts, it is the most rarely taken on the wing ; quite two-thirds of the specimens in the British collections being " bred " from larvæ, beaten like those of *S. pruni* from sloe bushes.

The males are all deep brown on the upper side, with a black discoidal lunule ; at the anal angle of the hind wings is an orange-red spot, and another at the base of the longer of the two " tails." The female, however, exhibits a band of rich orange-yellow on the fore wings ; the under side of all the wings in both sexes orange-yellow—rather the colour of a fading leaf—with a wedge of darker colour on the fore wings, margined with white, and a similar and larger wedge more distinctly edged with white on the lower. The white eggs are laid on sloe (in this country) in September and October ; for *betulæ* is one of the latest of our single-brooded butterflies. The larva emerges in early April, and when full fed is bright green with narrow stripes of white, and rests on the under side

of a leaf which it has *not* nibbled; just before pupation becoming rusty brown. The pupa is unattached save by the larval skin adhering to the surface of one of the two loosely spun together leaves selected.

A local insect of sluggish habits, the "Brown Hairstreak" occurs in many localities as far north as Dumfries, and also in some profusion in the southern counties of Ireland. In France it is known as the "Birch Thecla"; in Germany as the "Kidney Spot," from the black markings on the wings of the male; and the name *betulæ* was given it by Linnæus because, apparently, in northern latitudes it feeds on the birch, and not, as with us, exclusively on various kinds of *prunus*.

BITHYS QUERCŪS, L., THE "PURPLE HAIRSTREAK."—As the "Black Hairstreak" is accounted the rarest of its kind, the "Purple" is the most widely distributed next to the "Green." The two sexes show a very pronounced dimorphism, or difference of form. In the male the upper side of all the wings is a deep glossy purplish "Prussian" blue with black margins; in the female, the colour is blackish, with a large double violet patch on the fore wings, which in some lights appears as almost sky blue. The under sides are grey, and the band of deeper colouring contains an orange spot near the anal angle, with an orange blotch at the anal angle of the hind wings. The egg is laid on oak twigs in August, and the larva forms quickly and hibernates within the shell, emerging in April, when it bears a very remarkable resemblance in every way, colour, and form, to its surroundings. About the first week in June it is full fed, and suggests the flowers of the oak in tint: the back, fawn-coloured with brown yellow-bordered line; the rest of the body yellowish or reddish-brown. In Nature it pupates in a loose cocoon among dead leaves or under moss, remaining in this phase but a fortnight or so. Though born and bred

on oak, however, this gay little butterfly prefers the ash trees which are frequently mixed with oaks in our plantations; ranging south from Ross-shire, and over much of Ireland.

In France it is known as the "Oak Thecla"; in Germany as the "Little Oak Lustre"; as Linnæus's classical name *quercûs* faithfully indicates it should be.

STRYMON W-ALBUM, KNOCH, THE "WHITE LETTER HAIRSTREAK."—The rest of the "Hairstreaks" which are found in Britain and Ireland are wood-haunting species for the most part, and therefore confined to those areas which are not under cultivation. They are extremely local, and their relative abundance and rarity appear to be more or less seasonal. The "White Letter Hairstreak" is a good example of this. In some years it has been known to swarm in neighbourhoods where wych-elm, the food plant of the larva, is common. Then, for years together, it is only reported occasionally, though there can be ... le doubt that its secretive habits, and the difficulty of distinguishing the butterfly on the wing, account for this apparent scarcity.

The fore wings are all brownish-black, the hind wings being furnished with two small "tails"; at the anal angle of the latter is a small orange spot: the male exhibits a small oval blotch on the fore wings. On the under side, which is brownish-grey, there is a white line across the fore wings; while the hind wings carry the characteristic white W, with a broad marginal band of orange. The greyish eggs are laid on the twigs of wych-elm, the larva, which closely approximates in colour to the leaf in its various phases, being purple-green to full green, emerging in spring. Pupating in a loose cocoon spun up between two growing leaves in early or mid-June, the perfect insect, which especially affects the flowers of bramble and privet, flies at the end of the month, or in early July. Absent from

Ireland, it has been found in Scotland only in the extreme south; while it is wanting also in the south-western counties of England, with some exceptions.

In France it is known as the "White double V"; in Germany as the "Zigzag Stripe"; and, though the genus to which it belongs has been saddled with the impossible name *Chattendenia*, it has always been *w-album* since 1829.

STRYMON PRUNI, L., THE "BLACK HAIRSTREAK," is the rarest and most localised of our British species, and though it has been reported from several counties outside the south Midlands where it actually occurs, the records are doubtless due to a confusion with *w-album*. Essentially a woodland butterfly, it may be found in certain copses, where sloe and privet form the underwood, in July and late June. All the wings are brown, but on the hind wings there is an antemarginal series of orange lunules, with *one* "tail," and a small blue spot inside it. The under side is yellowish-brown with a faint row of yellow-red spots near the outer margin; while the hind wings are adorned with a broad orange-red band spotted with black, which renders the insect almost invisible when at rest on a cluster of fading privet bloom. The eggs are laid on, and closely resemble the colour of, blackthorn stems; the larva hatches out in early spring, and when full fed is exactly the colour of a young sloe leaf; so the favourite method of hunting *pruni* is by beating the bushes which it is known to frequent into an inverted umbrella, or a sheet spread underneath—very much to the detriment of the trees, to say nothing of the larvæ themselves! Full fed about the end of May, the pupal phase lasts for about three weeks.

In France, where the "Black Hairstreak" is as local as in England, it is the "Sloe Thecla"; in Germany the

"Plum-tree Butterfly"; and the name of *pruni* was given by Linnæus, properly associating it with the food plant.

CALLOPHRYS RUBI, L., THE "GREEN HAIRSTREAK," enjoys the distinction of being the only British butterfly coloured vivid green on the under side, and, as such, especially well protected when settled on the brilliant spring foliage of the hawthorn, or other tree or plant it may select. On the upper side it is invariably a fawn brown; the male being at once distinguishable from the female by the oval blotch of lighter colouring on the fore wings. Usually the green under side is ornamented with an incomplete row of white spots crossing both wings about the middle; but an aberration in which the spots are wholly wanting is not uncommon. Single-brooded, and on the wing from the end of April to end of June, according to latitude, *C. rubi* occurs locally on moors, downs, and in woodland rides in many of our British counties, and in Ireland; though for some unexplained reason it is absent from some where it should certainly occur. The green egg is laid between the flower heads or on the leaf of several plants—*Leguminosæ*, *helianthemum*, etc.—the larva preferring the flowers, and in some cases even the fruits—of the wild strawberry, for example. Full fed in July, it is bright yellowish-green with stripes of yellow; and apparently burrows to pupate, or changes among the lower stems of the food plant upon the surface of the earth without any cocoon, remaining there for the following ten months, and capable of emitting when dry a sort of faint chirping sound.

In France the "Green Hairstreak" is known as the "Green Argus"; in Germany as the "Bramble Butterfly"; and it has retained its Linnæan specific name with little or no variation at the hands of successive editors. Several other species of "Hairstreaks" occur in France. These

are *C. avis*, a green "Hairstreak" closely resembling *C. rubi*, recently discovered in the eastern Pyrenees by Dr T. A. Chapman; *Strymon spini*, Schiff. (Plate VII., Fig. 10), a Southern species; *S. acaciæ*, F., and *S. ilicis*, Esp., the commonest; all the three latter being sloe-feeders, and on the upper side approaching in appearance our *S. pruni*.

RUMICIA PHLÆAS, L., THE "SMALL COPPER."—As far as the "Coppers" are concerned this is the sole British representative, the famous "Large Copper" of the fens, *Chrysophanus dispar*, Haw., having been extinct for more than half a century; and surviving elsewhere on the Continent only in the variety *dispar*, var. *rutilus* (*cp.* Part I., p. 63). *Phlæas*, however, is the least likely of all butterflies to suffer extermination, and though one of the commonest, occurring as it does from the Orkneys to the Channel, as well as in Ireland, it is certainly one of the most attractive of our insects. Double- and in hot summers sometimes triple-brooded, it first appears in May, sunning itself on field flowers, and in autumn especially affects Michaelmas daisies, ragwort bloom, and asters, even in the inner London parks. In the south of Europe it flies throughout the seasons. The fore wings vary in colour from hot metallic red to brassy yellow, and, in the rare aberration *alba*, Tutt, shimmering silvery white. The margins are deep glossy black, and the copper ground colour is more or less marked with black spots. The under side varies considerably in the depth of the yellow-brown tint; while, in warm countries, the later broods (=var. *eleus*, F.) present a very dusky appearance by reason of the extension and suffusion of the black markings, and develop two pronounced "tails" on the hind wings. Occasionally, also, the hind wings are ornamented with an antemarginal row of bright blue spots (=ab. *cæruleopunctata*, Tutt). The whitish eggs are laid

first in April or May upon the common sorrel, and, under the microscope, [illegible] strong resemblance to the sea-urchin: the larva when full-fed is bright green with reddish-pink dorsal markings—a combination of colour not uncommon with the sorrel leaf feeders, and the pupa of this generation may be found in May and June, suspended by the tail and secured to a leaf by a silken girth. The second brood is out about the end of July; the third, when there is one, in late September and well on into October, or even November, provided there be no keen frosts.

The French name for the "Small Copper" is the "Bronze Argus"; the German, the "Little Fire Butterfly"; and *phlæas* it has remained since first published by Linnæus. Two other representatives of this striking family have in old times been reported in England: *Heodes virgaureæ*, L., significantly dubbed the "Scarce Copper" (Plate VIII., Fig. 1); and, much more likely, *Chrysophanus hippothoë*, L., (Plate VIII., Fig. 2), the "Purple-edged Copper" (*cp.* Part I., p. 62).

A. II. SUPER-FAM. HESPERIIDES (URBICOLIDES), THE "SKIPPERS."

Fam. Hesperiidæ.

Sub-Fam. Urbicolinæ.

Augiades sylvanus, Esp., the "Large Skipper."—Apparently the "Skippers" derived their popular name from this the largest British species of the family. Both the old "Aurelians"—as the collectors of the eighteenth century called themselves—Moses Harris and Lewin, noted the "skipping" habit of this rather common little butterfly, which is extremely restless on the wing, and further never appears to settle for long on bramble leaf or grass stem—

for I have not observed that it cares much about flowers—turning quickly round on alighting, almost as a dog turns from inherited caution against an enemy, before he settles down to slumber. Darting from leaf to leaf in the sunshine, or from blade to blade, with the characteristic energy of its kind, it is one of the "common objects" of a country walk in most of our English counties in late June and July. It is generally commonest on the outskirts of copses, occurring as far north as Wigtownshire, and in Ireland in Kildare, Kerry, and Wicklow. But in France I have found it by no means a usual insect; probably due to the fact that so much of the woodland and waste land has come under the sedulous cultivation of the peasant proprietor.

The greyish-yellow eggs are laid in July or the beginning of August on various kinds of coarse grasses, either singly or in straight rows; the female, seated on the upper side of the blade, curving her abdomen to the under side for the purpose. The young larva's first meal is the egg-shell; and then, after feeding for a month or so, it spins together the blades and forms a snug little tube in which it closely fits, thus passing the winter. In the spring it recommences feeding, but constructs a similar tube for pupation, and when full fed is pale bluish-green, striped with darker green; the head crimson-brown. The perfect insect emerges from the middle of June onwards.

The butterfly varies extraordinarily little. The wings of both sexes on the upper side are fulvous brown with a row of paler spots on the middle of the fore wing, and a lighter blotch from centre to base, the same scheme appearing on the hind wings; while the under side is usually more or less yellow. The male, however, is distinguished by the black streak on the fore wings, which is wanting in the female.

In France the "Large Skipper" is known as the

"Sylvine"; in Germany as the "Rust-coloured Butterfly"; and it has from the first retained the original name of *sylvanus*, given it by Esper, a hundred and twenty-five years since.

URBICOLA COMMA, L., THE "SILVER-SPOTTED SKIPPER" (Plate VIII., Fig. 9), is a chalk down species, and where it occurs in England is usually abundant. I have found it in great quantities on the Chiltern Hills, where it flies rapidly close to the herbage, stopping to sip the honey from an occasional hawkweed, or other low-flowering plant. But the preference for chalk and limestone is not noticeable elsewhere; and this stout-winged little butterfly has an enormous range of flight. I have taken it in some numbers in the sunny glens that reach down to the great lakes of Swedish Lapland; as well as in the Swiss Alps, where it flies up to 7,000 feet at least, and is one of the last lowland species to greet the eye of the collector as he emerges above the tree zone. On the Mediterranean Riviera it is equally common, and except that the northern and alpine forms have a greener under side (= var. *catena*, Stgr.) and in the mountains the wings are usually of a darker hue (= var. *alpina*, Bath), the tendency to variation is not marked.

In shape and size *U. comma* is very close to *A. sylvanus*: the colour of all the wings is the same bright fulvous brown, and the paler markings are arranged in much the same way. The male may at once be distinguished from the female by the presence of the dark velvet-black streak on the fore wings inset with mother-of-pearl; it is usually smaller, and the scheme of yellow markings on the upper side of the wings less decided. The under side is yellowish-grey, having both hind and fore wings spotted at the apex, and the lower also studded with a band of strongly-marked white spots, these very rarely assuming the yellow ground colour (=var. *flava*, Tutt).

A single-brooded species, the eggs are laid upon various

grasses (and, according to some authorities, on bird's-foot trefoil and allied plants) about the first week in August, quickly assuming the colour and appearance of a granule of chalk splashed on the blade of grass. The larva (Fig. 9*a*) emerges in the following April, and spins at once a tube-like shelter on the blade, emerging only by night to eat, and therefore extremely difficult to observe in Nature. Full fed it is of "a dirty greenish-grey" colour, and about the end of June it spins a cocoon very near the ground, into which are woven little pieces of grass, sand, etc.; the inside covered with a sort of asbestos-looking fibre (Chapman).

In normal seasons *U. comma* is on the wing throughout August in England: but occurs neither in Wales (which is remarkable), Ireland, nor Scotland. Except in Cornwall, it may be taken in all the southern counties; and a single specimen is reported as far north as Stafford; but, judged by its northern extension on the Continent, its absence from the Scottish mountains—where the fauna so closely approximates to that of Scandinavia—is unaccountable.

The "Pearl-spotted Skipper" has no French equivalent; in Germany, it is the "Streaked Butterfly," or "Thick Head"! But it has been so fortunate as to retain its original classic denomination from the days of Linnæus without change: though the name of the genus *Urbicola*, to which it belongs by right of priority, has been altered a half-dozen times at least.

Sub-Fam. Thymelicinæ.

THYMELICUS ACTÆON, ROTT., THE "LULWORTH SKIPPER."—If you mentioned the "Lulworth Skipper" to a foreign collector he would perhaps express a polite interest, but the name would convey nothing to his mind. But, having discovered this butterfly in one of its few haunts on the

south coast, the author of the name was filled, no doubt, with a laudable desire to do honour to the locality. The scientific donor of the classical name, moreover, insisted on spelling *actæon* "*acteon*," so the strict name of the "Lulworth Skipper" perpetuates his error. I prefer to sacrifice priority to correctness, and retain, as elsewhere, the proper spelling, where the mistake is obvious.

The "Lulworth Skipper" is easily distinguished from the two preceding members of the family described, by the uniform darkness of the upper side of all the wings, which are further suffused with a greenish tint. In the male, the "comma" mark or streak on the fore wings is more heavily outlined: the fringes being yellowish-grey. The colouring of the under sides in both sexes is uniform greenish-yellow. But the female may be distinguished from the male by the absence of the black streak, and the substitution on the upper wings of a pale crescent series of markings—in the male sometimes visible, but rarely so. There is a clear-brown form of the butterfly which occurs in the French Alps, etc., the coloration more closely approaching that of the "Small Skipper," *Adopæa flava*.

In England this butterfly is one of our rarest and most local species, though still occurring in some profusion in good seasons on the actual spot where it was discovered by the late Mr. J. C. Dale eighty years ago. Confined entirely to the western counties of Cornwall, Devon, and Dorset, the last mentioned constituting its headquarters, it may be that this is one of the butterflies which have come over from Normandy and successfully colonised our coasts; for it is a remarkable fact that, so far as is known *accurately*, *actæon* has never penetrated inland. The few spots which it favours are of the under-cliff order; and there, as I have found it always in its alpine homes, it loves to rest, and at night to

sleep, on the sedges and flowering rushes, the folded brown wings, as it lies close to the rush head, affording an admirable protection.

It is not quite certain at present whether the young larva, which has been found in May on its grass food plant, *Brachypodium pennatum*, passes the winter in this phase or within the egg. When full fed about the end of June it is green with a fine double dorsal line of yellow. The apple-green pupa is "enclosed between two or more grass blades drawn closely together and lined with silk so as to form a cocoon," and in this phase it remains until the middle of July, or even into August; there being but one brood in England at all events.

As with most of our British "rarities" this butterfly is having a severe struggle for existence, and though I think in nine cases out of ten the talk of extermination by over-collecting is ill-founded, with this species and the "Large Blue," *Lycæna arion*, the destructive human element is rightly held to blame. The "Lulworth Skipper" does not appear to enjoy a French name; in Germany it is called the "Ochre-coloured Butterfly."

ADOPÆA FLAVA, BRÜN., THE "SMALL SKIPPER," is more generally distributed than the preceding species, but not north of Yorkshire; and, though never authentically reported from Scotland, and at no recent date from Ireland, it may be expected to occur elsewhere in much the same places as *A. lineola*. In my own collecting I find it partial to chalk downs, and banks covered with masses of summer vegetation. As active as a humming-bird, whose movements it somewhat recalls on the wing, it flies "buzzing" round the favoured flower, or takes short lightning flights among the grasses, pausing ever and again to enjoy the warmth of the sun's rays with wings outspread in the peculiar

"Skipper" fashion. The four wings on the upper side are warm fulvous; as I think, decidedly warmer in tone than is the case with *A. lineola*. The markings of the nervures are throughout more pronounced, and in the male, which is distinguished thereby from the female, the oblique mark on the wings is heavy and pronounced; while in the female it is entirely wanting. Before the days of Linnæus these sexual differences of marking were so little understood that authors came to the conclusion that the male and female were two entirely different species. The "Skippers" have a plate devoted to them in John Ray's works, and the names given them at the close of the seventeenth century are almost as quaint as those more than a century later conferred on the moths by Haworth and others.

The "Small Skipper," apparently, has but one brood here; but, if this be the case abroad, the period of emergence must be greatly delayed in many cases, for while I have taken it perfectly fresh in the Piedmontese mountains the third week in June, I came across a weather-worn little colony on the heights overlooking the Mediterranean on October 9, 1902. While it seldom varies in appearance, I once, also, took an example on the Simplon Pass below Berisal in which the whole of the brown colour of the wings was changed to silvery white.

Usually the egg is laid on grass blades in July, and, unlike that of *A. lineola*, the little larva emerges in August, but after a short time constructs a shelter for itself by spinning together the edges of a blade of grass, and in this retreat it remains dormant until the warm days of early spring. Eventually it repeats the performance on a larger scale, for pupation, attaching itself in this phase by a short girdle of silk to keep the head upwards, and fixing the tail hooks in a little pad constructed for the purpose. The pupa

is the same colour—pale green—as the larva, which is further distinguished by green dorsal lines, with a whitish line down the sides. When quite young the larva is likely to be confounded with that of another entirely different species, the "Wood Argus," *Pararge egeria*, according to Esper.

The name *flava* was given this butterfly as long ago as 1763: most of our British writers have described it as *thaumas* or *linea*. In France it is popularly called the "Black Band" (from the male markings); in Germany the "Enamel Butterfly."

ADOPÆA LINEOLA, OCH., THE "ESSEX SKIPPER."—For a century British collectors overlooked the presence of this common Continental species in England, by reason of its similarity to the "Small Skipper," *A. flava*. In the field, no doubt, they bear a close resemblance to one another; but compared side by side in the collecting-box or in the cabinet, it is not difficult to separate them. All four wings are of a tawny orange-brown, the males showing a streak of black on the fore wings, which does not, as in *flava*, turn towards the inner margin; while the nervures, as a rule, are marked more distinctly. But the easiest way to divide the two butterflies is by examining the *under sides* of the clubs of the antennæ. In *lineola* the tips are black beneath: in *flava* they are brown, or reddish; while the hind wings on the under side are without the bright patch of orange at the angle nearest the body, and of a uniform pale tawny.

On the Continent this gay little butterfly flies from the earliest morning until sunset, engaging in battle many species four times its own size, and chasing them away from the coveted knapweed, or other flower which it affects. Wherever there is a patch of damp on the mountain path or dusty road the males will assemble in hundreds to suck up the warm moisture, scrambling over one another and the

many "Blues" attracted to the same spot. In England the headquarters of the species, where it was first discovered, or rather distinguished by Mr. Hayes, was, and still is, in the river marshes about the sea-wall near Southend-on-Sea. But that it is much more widely distributed goes without saying, as there are records from Beds., Cambridge, the fens of Huntingdon, the Kent coast round Sheerness, Northants., Suffolk, and Sussex. So that the collector will do well to capture and examine every small brown "Skipper" that he comes across in these and other suitable localities.

In England the butterfly has but one brood from the last days of June to the first weeks of August (in a late season). The egg, which is flat and, therefore, most un-butterfly-like, and has been described as of the shape of a bean, is laid upon various coarse grasses, such as *Lolium perenne* and *Cynosurus cristatus:* the larva develops in the egg-shell about August, but does not eat its way out until the following April. Full fed it is yellowish-green, with four yellow stripes on the back; finally it spins together the blades of the food plant, and in this tent remains a pupa for a period of fourteen to twenty-one days.

Those who are responsible for such things appear to have had a difficulty in finding a popular name for this welcome addition to our list. Mr. South calls it appropriately the "Essex Skipper." In France apparently the entomologists have failed entirely to christen it; and in Germany it is the "Corn-bird"; while, unlike most of its kind, the scientific name has remained fairly constant since it was first described by the German naturalist, Ochsenheimer, in 1808.

Sub-Fam. Cyclopidinæ.

CYCLOPIDES PALÆMON, PALL., THE "CHEQUERED SKIPPER" (Plate VIII., Fig. 10).—Next to the "Lulworth

Skipper" this is the most local of all the group under review, and it was not until I had been collecting many years that I had the pleasure of watching *palæmon* in its very restricted native haunts. In this particular case it was a wood on the borders of Northants. and Lincolnshire; a lovely morning at the end of May; and a wealth of forest flowers in full bloom. The hyacinths were already on the wane; but the wood paths were gay with bugle and yellow-rattle, and on the outskirts, the grasses, long and lush, were alive with insects of all Orders. I had read that *palæmon* preferred the blue flowers of the bugle; but I did not see a single specimen on this occasion upon them. All were flitting—with a rather dragon-fly flight—over the herbage, pausing for a moment to display the jewelled wings which constitute this species the most exquisite of its kind.

The " Chequered Skipper " is, indeed, to be mistaken for no other of its British allies. The ground colour is deep brown, and when the insect is quite fresh the wings are dusted with fine yellow: the upper side of the fore wings and hind wings is spotted with bright yellow, and the under side, which is washed with ochreous yellow, reproduces the markings of the upper side in pale relief. Males and females closely resemble one another; but the heavier body of the latter is sufficient distinction, and in the cabinet, at all events, the yellow spot markings of the female appear larger and more conspicuous.

In the United Kingdom this butterfly is confined to an extremely narrow line of country, roughly speaking the eastern Midlands between the Humber and the Nene, though it must once have been more widely spread, as there are authentic modern records of its occurrence in Devonshire and Oxfordshire. To-day, however, it is in the woods of Lincolnshire, Northants., Hunts., and Nottingham that

palæmon must be sought. Abroad it has a wide range in northern Europe, and down to the Alps (where it flies as high as the Maloja Pass in the Engadine, 6,000 feet), but is always local.

The eggs are laid, in Nature, preferably on the cock's-foot grass, *Panicum crus-galli*, or *Bromus asper*, early in June, or at the end of May; and the larva conceals itself in a tube-dwelling of grass similarly constructed to those of *tages* and *malvæ*. When full fed (Fig. 10*a*) at the end of August it is pale whitish-green; but the colour gradually disappears until it is, like many larvæ which hibernate, a sort of transparent "ground-," and finally of a delicate cream-colour. About the middle of the following March it begins to move, and without further feeding draws the grass blades together, and inside this shelter selects a broader blade upon which it spins a small carpet of silk, and changes to a pupa of the same colour as the hibernated larva.

In France this butterfly is the "Chess-board"; in Germany, the "Gold-brown Thick Head"—the latter name being common apparently to the group: but after a middle period, during which the later *paniscus* of Fabricius was substituted for the earlier *palæmon*, and *brontes* of Schiffermüller, our modern authorities have very properly reverted to the name of *palæmon*.

In northern Germany, along the shores of the Baltic, and in Scandinavia occurs the closely allied *C. silvius*, a bright little butterfly more broadly chequered than *C. palæmon*.

Sub-Fam. Hesperiinæ.

Having thus briefly described the "Brown Skippers" of the British Lists, I pass to what are commonly known as the "Black-and-white Skippers." On this side of the Channel

we have but two species to include, the "Grizzled Skipper," *Hesperia malvæ*, and the "Dingy Skipper," *Nisoniades tages*; for the recorded captures of *Hesperia alveus* are suggestive of foreign imports, rather than immigrants, much less indigenous species. And perhaps this scarcity is as well, at all events for the beginner; for, until quite recently, the utmost confusion has existed in the classification of the many Hesperiid butterflies which increase the farther south and east we go. Since, however, the Swiss naturalists especially took the matter in hand, and proceeded to examine closely the body structure of each supposed species or variety, some order has at length been attained; for it is abundantly clear that no one could hope to distinguish these various "Skippers" from one another by the test of wing markings alone. The problem, therefore, was transferred from the field to the museum, where it has been satisfactorily solved *up to a point*; but until all the "Black-and-white Skippers" have been bred from the egg to the perfect insect, it will be impossible to establish those "facts," which will give them their permanent place in the classification of the Old World Hesperiid Family. In Britain we are confronted with no such difficulties; though it is curious to note that our little "Grizzled Skipper" on the Continent was until recently confused with another species, *Hesperia malvoides*, Elw. and Eds., which flies in August not uncommonly in the mountains, as well as earlier in the plains. So closely do the two resemble one another *superficially*, that the August butterfly was universally accepted as the second brood of the April-May *Hesperia malvæ*. We know now, however, that the two supposed generations are of butterflies wholly distinct from one another, though to all appearances one and the same species. Here at home a similar case of concealed identity prevailed in the case of the "Ear Moth," *Gortyna nictitans*, Bkh.;

no less than two species having been discovered " masquerading " under the name and description of this particular Noctuid! As it is, the oldest hands, working the " Black-and-white Skippers " of the Alps and of the Pyrenees, to say nothing of the lowlands, will hesitate to label their captures until they have compared them with named species in the cabinet, or those of the group which have been so magnificently figured by the Swiss artist, M. J. Culot, in M. Charles Oberthür's minute studies[1] of butterfly variation.

HESPERIA MALVÆ, L., THE " GRIZZLED SKIPPER " (Plate VIII., Fig. 11).—Flying among the white-flowered stitchworts, the scented hyacinth, and occasionally settled on a buttercup—the only one of our British butterflies I have noticed visiting this flower—the " Grizzled Skipper " may generally be found in woods and clearings as the days lengthen out with the spring. Strictly speaking, it is the sole representative of the " Black-and-whites " which occurs in the United Kingdom ; but in its southern haunts, at least, it is common, and in hot forward springs I have found " the roughs " at the outskirts of our Middlesex woods teeming with this smallest of Hesperiids.

The popular English name rather well describes the general appearance of the insect ; that is, the upper side of all the wings is blackish-brown decidedly tinged with green ; and in the males, as a distinguishing character, there is a sprinkling of greenish-grey where the fore wings join the body. The under side, however, presents a considerable variety of tints, in the female especially, the colour scheme ranging from warm olive-green to a bright almost crimson : suggestive of the various hues of the bramble leaf upon which the female lays her eggs, in the spring season before the fresh young green is developed in full, and doubtless for this

[1] " Lépidoptérologie Comparée," Rennes, April 1910.

reason a useful protection for her. Occasionally, by the enlargement of the spots, the wings appear extensively invaded with white; this is the not uncommon aberration *taras*, Bgstr., a form nearly invariably confined to the male sex.

The pale green eggs are laid on the bramble, in early June or at the end of May, and sometimes on *potentilla*, and as soon as the young larva emerges, it spins a little silk shelter on the midrib of a leaf, under which it remains devouring the soft part until about the middle of August. Then, after a rest period of some days, being "either greyish-purple or greyish-green in colour, with dark and pale longitudinal lines," it spins another shelter, similar to the one in which it has been feeding—but the silk yellow instead of white—and in this it pupates and passes the winter. In captivity also it takes quite kindly to the strawberry plant of the garden. But there is no second brood in Britain; or anywhere else, it would seem; since the so-called *malvæ* of August have been found to be *malvoides*, a separate species, the varieties hitherto assigned to *malvæ* appearing at this time of year being therefore varieties of *malvoides* (=*fritillum*, Rbr.), or that butterfly itself.

Taken as far north as Inverness—though reported rare in Ireland and Scotland, the "Grizzled Skipper" ranges far from the north, to the south and east of Europe and Asia. In France the butterfly is known by the odd name of the "Plain Chant," the square white spots suggesting the old methods of monkish musical notation; in Germany, as the "Little Mallow."

In the land of scientific literature it has actually been called *fritillum*, *sao*, and *lavateræ*, all names belonging to other "Skippers," as well as *alveolus*, and the pity is that it should be associated in its first and last name with the mallow, a

plant which it is not known to affect at any stage of its existence.

NISONIADES TAGES, L., THE "DINGY SKIPPER," unlike any other of its British cousins, is sometimes in very hot seasons partially double-brooded. It also possesses superficial, as well as structural peculiarities, which entitle it to be reckoned a true connecting link between butterflies and moths. But, being a day-flier, with its strongly clubbed antennæ, it could hardly be mistaken on the wing for a moth. Yet, when resting, the wings are folded moth-fashion—that is, not carried erect above the body; and in this position, on a seed-head, or brown stem of grass, the resemblance to a small Noctuid moth is obvious, while the "dingy" colour simulates wonderfully the surroundings chosen for a night's lodging.

The wings are folded exactly like those of the Swift Moths (*Hepialidæ*) when the butterfly is at rest; indeed, so close is the resemblance that recently when collecting in the Pyrenees I boxed what I thought a resting *tages* to find that it was, after all, no butterfly, but the dark counterpart of our garden pest, *Hepialus lupulina*, the "Small Swift" —*H. alticola*, Obthr.—and as such to be counted something of a rarity.

Like all "Skippers," *tages* loves the sunny downs, where it can bask upon the warm exposed chalk. But it is not particular in this respect, and often accompanies the "Grizzled Skipper," *Hesperia malvæ*, in the clearings of woods; and, in the rare event in Britain of a second emergence, displays a taste for bracken fronds, from which it rises, on being disturbed, to return again a little later.

The ground colour of all the wings on the upper side is dull brown, overlaid with broken bands of darker brown and grey: the under side is uniform ochreous-yellow; and it has

been suggested that this is due (as in most moths) to there being no necessity for a protective pattern, as the under sides of the *folded* wings are not displayed.

The eggs, which from pale yellow become deep orange, are laid in this country upon *Lotus corniculatus*, the bird's-foot trefoil, or *L. uliginosus*. Like other "Skipper" larvæ, they make themselves little habitations—three leaflets spun together in tubular form: the full-fed greyish-green fusiform larva in mid-August also constructing a winter shelter, but this time away from the food plant among dead leaves, etc. where eventually it pupates in the following spring. The second emergence is produced by "forwards" of the June-born larvæ feeding up under very favourable conditions of climate and food. There are no named varieties occurring in Great Britain, but the typical "Dingy Skipper" ranges from the southern English counties to Inverness, though curiously enough it is absent from counties where it might reasonably be expected—notably Norfolk. In Ireland it is distributed from Fermanagh to Kerry; while upon the Continent it is ubiquitous in suitable localities outside the Arctic circle.

In France the "Dingy Skipper" is known as the "Point de Hongrie" (a sort of dark lace?), or the "Grisette"; in Germany the "Eryngium Butterfly," as the larva is known to feed on *E. campestris*; and happily the mistake of spelling *tajes*, perpetrated thirty years after Linnæus had christened the butterfly *tages*, was not copied by subsequent authors.

MOTHS.

AA. III. LYMANTRIIDES.

Fam. Lymantriidæ (Liparidæ).

In this family the larvæ are remarkable for the urticating, or stinging, properties of the hairs with which, for the most part, they are clothed plentifully. Fragments of these hairs are also woven into the cocoons; while it is even averred that the scaling and hairs of the moth-wings themselves provoke an irritation, not unlike that of the nettle. Care, therefore, is required when handling these species, but especially in the larval phase.

Orgyia gonostigma, F., in England, has been christened the "Scarce Vapourer," though I am at a loss to suggest any intelligible meaning for the second part of its name. The family to which it belongs is also popularly known as the "Tussocks," and with better reason, for some at least of the odd-looking larvæ carry dorsal tufts of hair on the fifth and sixth segments rather like shaving-brushes! In the case of *gonostigma* these four brown tufts are supplemented with a tail-tuft of bluish-black; the body of the black velvet quality; the light yellow dorsal line is edged with orange-brown, and the lateral black margined with the same colour above the legs and claspers. It feeds on many trees, but prefers oak, and there are two broods of moths every year—the first in June, the next in August. But it is very local in its habits, ranging nowhere north of Yorkshire; and the fact that the female is wingless, and never leaves the neighbourhood of the cocoon from which

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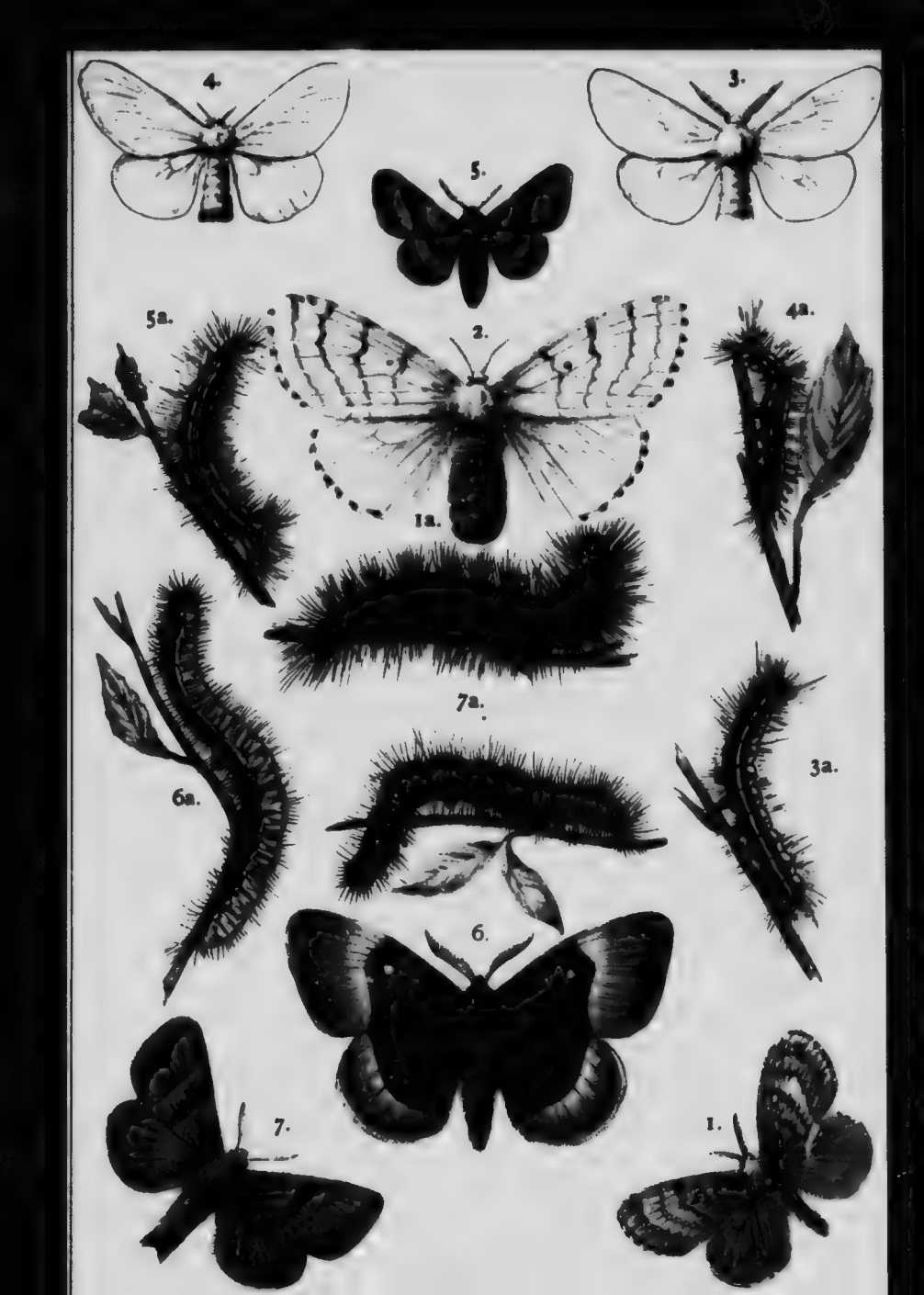
she has emerged, and on which she deposits her ova, makes it an extremely difficult species to discover in its known English haunts.

ORGYIA ANTIQUA, F. (Plate IX., Fig. 7), is certainly one of the commonest of our day-flying moths. It is practically universal throughout the kingdom; and the larva being polyphagous, and apparently able to digest the smoke-begrimed foliage of our city parks, it is a common London insect, zigzagging about in the sunshine among the planes of even such unrural spots as Lincoln's Inn Fields. The "COMMON VAPOURER" is uniform "varnish" brown, with a large white spot near the lower angle of the fore wings; but there is no apical spot of lighter colour or white as in *gonostigma*. The female, also, though still incapable of flight, has something more in the nature of developed wings. Like the preceding species, she lays her eggs on her discarded cocoon, and the resultant larvæ, when full fed, are brilliantly coloured, tufted, and active. The four body-tufts white, tipped with brown; the body velvety black-blue, with a velvet dorsal stripe interrupted by vermilion tubercles; the sides similarly adorned with red about the spiracles. The cocoons may be found under wall-copings, in the crevices of tree-trunks, etc., and the perfect insects from spring-laid eggs make their appearance in September.

DASYCHIRA PUDIBUNDA, L., THE "HOP-DOG," received its name from its former frequency in old-fashioned hop-gardens. But later it has been re-christened the "Pale Tussock," to distinguish it from its more northern congener the "Dark Tussock," *D. fascelina*. The larvæ of both species fully justify their family name of "Tussock." They are subject to some variation in the final and preliminary moults, but the typical "Hop-Dog" is greyish-

black, the three tufts rather lighter, and the whole body covered with strong blackish hairs; in lighter examples, with reddish-black hairs. But it is not confined to the hop, like the other "Tussocks" adapting itself to almost any tree. The perfect insect emerges in May and June, in suitable localities showing a special weakness for the collector's lamp. It is rather "puss"-like in appearance; variable in colour, but the fore-wings usually purplish-grey with the central bands well marked, and in some examples almost black: the female altogether larger and lighter.

EUPROCTIS CHRYSORRHŒA, L.—In this genus we get away from the "Tussock" type, and find instead an extremely sinuous, active larva, generally brightly coloured, and having the urticating properties of the thick hairs accentuated. The "BROWN-TAIL MOTH," for some reason or other, has become very rare in England, where it was always confined to the coast, and a similar tendency to diminish is reported also from the other side of the Channel. In the United States, on the contrary, it is super-abundant, and scheduled as one of the most destructive larvæ. The moth, with its four wings of shining satin-white and the mahogany tuft of the tail, is quite unmistakable. The larvæ are hatched out in August from batches of eggs which are additionally protected from marauders by the brown tail-hairs of the parent glued tightly to them. They soon commence to hibernate, spinning in companies a sort of web-nest for the purpose. This process is repeated until they are full-grown, when they are of a warm sepia brown, with white lateral markings and the dorsal warts yellow-orange: and the sociable habit is even carried on through the pupal stages, one or two pupæ being found not infrequently cuddled together in the same webby cocoon. (Plate IX., Fig. 6).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Description of Genera and Species

PORTHESIA SIMILIS, FUESSL. (Plate X., Fig. 4).—This extremely common and beautiful insect differs from the preceding in the smaller size of both sexes, the presence of a golden-brown spot on the fore wing, and the tail tuft bright golden. The eggs are laid on hawthorn, and protected in much the same way: the larvæ, both before and after hibernation, social; but eventually separating, and at the last moult, with their black bodies and strong vermilion-and-white striping, conspicuous objects on the hedges in May and June. The perfect "GOLD-TAIL" is on the wing at the end of June, and may often be found, motionless and asleep, on palings and gate-posts. Generally speaking, it does not extend farther north than Lancashire and Yorkshire.

STILPNOTIA SALICIS, L. (Plate X., Fig. 3). — This, the last of our snow-white Lymantriids, is lustrous white on wings and body alike; sometimes, as we have seen them disturbed in numbers from some riverside willow in the upper alpine valleys, suggesting a veritable fall of snow. As a rule the "SATIN MOTH" is common in the southern counties, but occurs only sporadically elsewhere. The gregarious larvæ are distinguished by the dorsal white spots ornamented with crimson and velvety markings, as they move with extreme rapidity across the dusty highways, when, as frequently happens, they are shouldered off the foliage by their hungry brethren. The pupa is almost as hairy as the larva, and also very active, wriggling from side to side when disturbed.

LYMANTRIA DISPAR, L. (Plate X., Figs. 1 and 2), THE "GIPSY MOTH," is yet another curious instance of disappearing species in the British Isles; though destructively abundant in other countries under apparently the

same climatic conditions as our own. Over half a century since it was common in the fen land (abroad it is ordinarily a hedgerow species); then it disappeared, and, as with *Pygæra anachoreta*, Hb. (*cp.* p. 189), is only kept British by rearing in confinement—with one very curious result in my own experience, the males without exception emerging from the pupa with a "half-moon" sliced out of the inner margin of the hind wings. In Nature the eggs are laid in August: the larvæ hatch out in April, and I have bred them on hawthorn. When full fed (Fig. 1*a*) they are yellow or brown, with ten parallel blue dorsal spots, and thirteen similar red or brown spots in continuation. They spin a tough cocoon in the branches of the tree on which they feed; and in the United States, where it was introduced originally by accident, the depredations of the "Gipsy Moth" are widespread.

LYMANTRIA MONACHA, L. (Plate IX., Fig. 8).—This "Gipsy," otherwise the "BLACK ARCHES" is a more or less common English moth as far north as Yorkshire. The fore wings are white with marginal row of black spots, a chequered transverse median band, and a similar arrangement with black spots at the bases; the hind wings rather woolly greenish-brown; and the body, which is more broadly barred in the female, crimson with black bands. The eggs are laid in July and August in crevices of bark, the larva, which is an indiscriminate feeder, devouring pine needles as well as apple, emerging the following spring. When full fed (Fig. 8*a*) it is greenish-grey with a brownish dorsal line passing at intervals through large black blotches; the body covered with dense lateral tufts of hair on each segment. It spins up a thin cocoon in the bark, and has a decidedly metallic lustre. Occasionally melanic forms of the moth occur, the whole four wings deeply suffused (=ab. *eremita*).

Description of Genera and Species

AA. IV. SUPER-FAM. ARCTIIDES.

Fam. Arctiidæ.

Sub-Fam. Arctiinæ.

This sub-family provides us with many of the most gorgeously coloured of our moths, including as it does the "Tigers," with their scarlet and striped wings; the "Ermines," and the smaller, more sombre "Footmen."

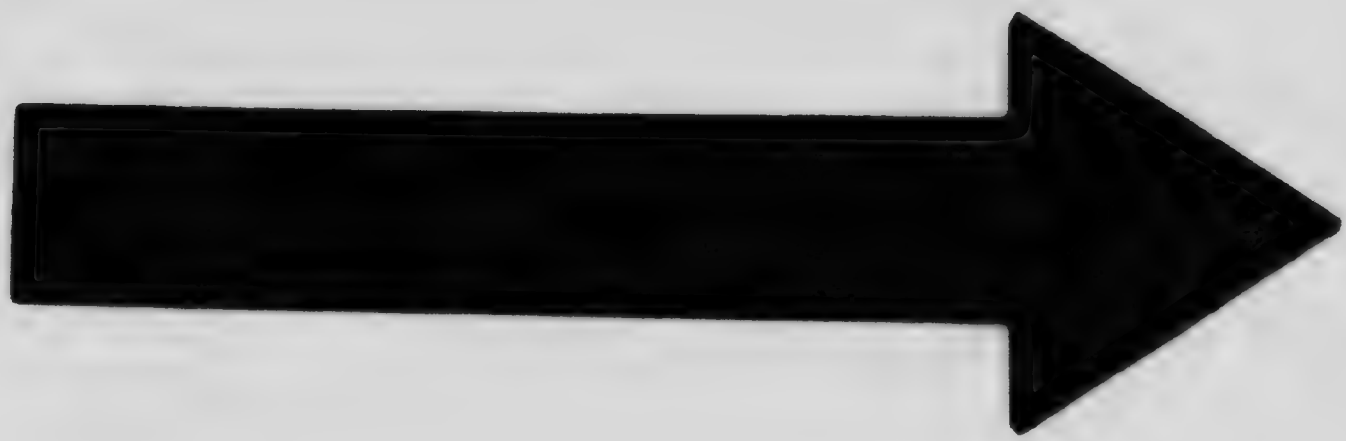
Spilosoma menthastri, Esp.—The English name of the "White Ermine" admirably describes this very common moth and its congeners: the fore wings white, freely spotted with black; the hind wings white, with occasional black spots near the margins. The polyphagous larva, which is brown and very hairy, with bluish lateral ground colour, and faint brown spiracular stripes, may often be caught footing it as fast as it can over the garden paths in September, when about to seek a corner for spinning up. The pupa hibernates; the perfect insect appears everywhere in June. Closely allied with it is the "Buff Ermine," *S. lubricipeda*, L., which varies from the nominal buff to the form *zatima*, an artificial product, in which the greater part of the wing surface is invaded by black. Then there is the equally abundant "Muslin," *Diaphora mendica*, Cl.: all of these worth rearing, however, for the very curious aberrations which they are prone to develop.

Phragmatobia fuliginosa, L.—In the "Ruby Tiger," that is to say the normal English form, the fore wings are rather transparent brownish-pink, with a small, double, discal spot; the hind wings ruby-red from the anal angle upwards, and to about the centre, where it is merged in bluish-black rather lighter than the deep outer marginal borders. The larva in shape and size is like that of *S.*

menthastri, but the dorsal lines are much lighter, and the body colour above the spiracles green, not bluish. There is a sort of superstition among collectors that it likes its food, dock, dandelion, and other low-growing weeds, with a touch of frost upon it. At all events the winter larvæ are quite impervious to cold, and lie out on the moors and elsewhere without seeking protection. Normally a night-flier, it has been taken in the sunlight as well, having a very extended range, from Land's End to the Orkneys.

PARASEMIA PLANTAGINIS, L. (Plate XII., Fig. 3), THE "WOOD TIGER," has the black fore wings barred and marked with broad light yellow; the hind wings, chrome-yellow to red-orange, marked with black; while in one rare form, ab. *hospita*, Schiff., the yellow is changed to pure white. The larva lives on plantain and other low-lying herbs: it is black, tufted with black hairs, but those on the fourth and sixth segments are reddish, set in a series of red warts. The moth is an erratic day-flier, and loves the sun on the warm chalk downside, heaths, etc. To the same group belongs also *Rhyparia purpurata*, L., of north and mid-Europe, figured on Plate XII., Fig. 2.

ARCTIA CAIA, L. (Plate XI., Fig. 4), THE "GARDEN TIGER," is quite the most brilliant of our moths, with its brown-black and cream-white fore wings, and vermilion black-blotched hind wings. With these colours there is an endless variety of markings, and I have seen collections of this one insect alone sold in the sale-rooms, including close upon five hundred examples differing one from the other in degree, until we have the fore wings with almost all the black invaded by the white, or the scarlet hind wings obscured by the black. The larva is the extremely common "Woolly Bear" (Fig. 4*a*). It will eat almost any low-growing weed, but is rather subject to mould on its fine hairs



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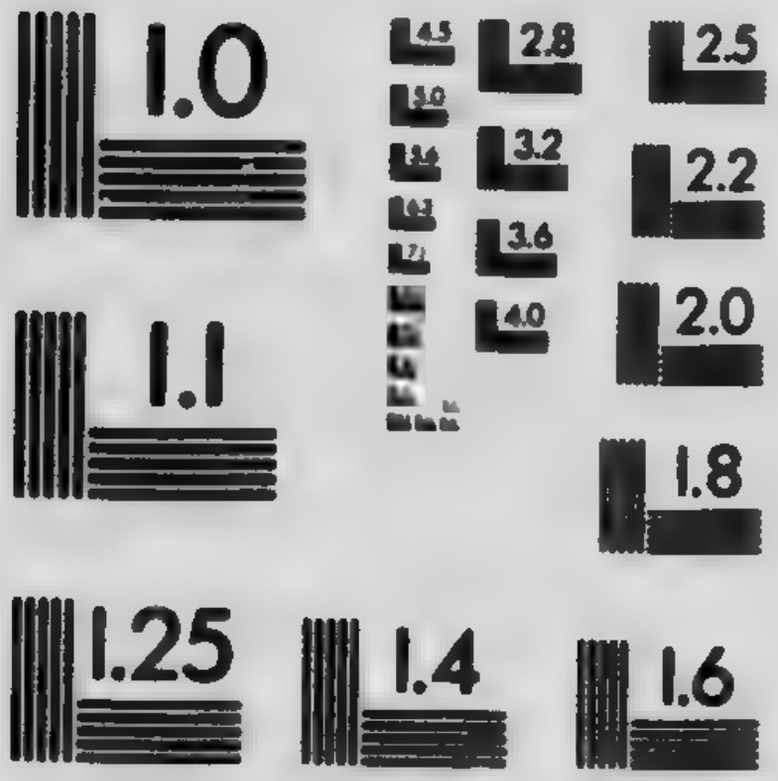

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during the period of hibernation. The moth is out in July, and is generally distributed.

ARCTIA VILLICA, L. (Plate XI., Fig. 5), THE "CREAM-SPOT TIGER," is much more restricted than *caia*, and hardly flies north of the Trent valley. Instead of the vermilion of its congener, the fore wings are black, blotched with cream-yellow, the scheme being reversed on the hind wings; the body crimson-red, and the thorax black. The larva does not suggest quite so obviously as that of *caia* the bearskin of a Guardsman; the brown hairs are set in little spangles on the black segments; the head and legs are reddish. It is also not particular in the matter of diet: hibernates in this phase: and the perfect insect emerges in July. The pretty "Tiger" figured Plate XII., Fig. 1, *Arctia aulica*, L., is a mid-European species.

CALLIMORPHA QUADRIPUNCTARIA, PODA (Plate XI., Fig. 7).—This magnificent thin-bodied "Tiger" has been called the "JERSEY TIGER" in England, by reason of its abundance in that island. I have discussed elsewhere how a few insects pass across the Channel (*cp.* Part I., p. 61). The fore wings are black barred with white: the hind wings, scarlet with a larger discal black blotch, and a broken broad black antemarginal border. In some instances, however, the scarlet is superseded by a rich orange colour (=var. *lutescens*, Stgr.). The larva indulges the family taste for low-growing herbs, dead nettle, dandelion, etc.; the moths laying freely in captivity. Full grown (Fig. 7*a*), it is black, with an orange dorsal stripe, and lateral white spots: in this phase it hibernates, the perfect insect appearing in July. Abroad it is one of the familiar insects of the alpine roadside, and prefers the dull-pink flowers of the hemp agrimony to anything else. At home it is limited to the coast of South Devon at present, though casual immigrants

have been taken elsewhere: indeed, I myself in 1877 captured the solitary Isle of Wight example close to the beach of Bonchurch.

CALLIMORPHA DOMINULA, L. (Plate XI., Fig. 6).—Mr. South well describes the "SCARLET TIGER" as a "tropical-looking" moth: it suggests South America and the Amazons in the rich intensity of its colours: the fore wings sheeny black-blue, with white and yellow spots; the hind wings and body pure crimson, with a few black blotches. Common enough where it occurs, especially on the south-east English coast, it is very local, and does not fly north of Wicken Fen, I think. I have reared the larvæ on nettle. They are black and hairy, with a dorsal broken row of yellow spots repeated on the sides (Fig. 6*a*).

HIPOCRITA JACOBÆÆ, L. (Plate XII., Fig. 5).—This lovely moth is the "CINNABAR," and quite unlike any other occurring in Britain. The fore wings are greyish-green with two carmine outer-marginal blotches, and a long carmine line, connecting the apical spot with the base, running parallel to the costa; the hind wings pure carmine. I have found it very common sometimes in the Middlesex and Norfolk woods, and it has an extended range in the three Kingdoms. The orange, black-ringed larvæ may be found clustered on yellow ragwort; it spins a slight cocoon on the surface of the ground in August, and the perfect insect emerges the following May and June.

Sub-Fam. Lithosiinæ.

This sub-family includes the "Footman Moths' an absurdly unmeaning name even if it be an allusion to the folding wings over the long body, which might conceivably suggest the livery tail-coat of the "gentleman's gentleman" of the Georgian period. The fifteen British

representatives bear a strong likeness to one another: the larvæ are hairy, and they are all lichen-feeders.

In CYBOSIA MESOMELLA, L. (Plate XII., Fig. 4), the characteristic "FOUR-DOTTED FOOTMAN," the fore wings are plain cream, with four minute central dots at the costa and inner margin; the hind wings suffused yellowish-grey. The larva is deep slaty black, with tufts of feathery greyish hair; it feeds on the lichens that cover the oak, hibernates in this phase, and pupates in the crevices of the bark. The perfect insect is generally distributed, and flies in June on heaths, and in grassy woodlands.

LITHOSIA COMPLANA, L. (Plate XII., Fig. 6), is the "SCARCE FOOTMAN" — the fore wings lead-grey with a broadish costal margin of buff carried through the apex to the fringe; two light grey horizontal dashes beneath: the hind wings pearly ochre. The larva feeds on the lichens of fir trees: it is described as "brown with a very dark brown head and dorsal line." The moth is local on heaths, commons, and sea-side wastes in July and early August; common in Ireland, but apparently not known in Scotland.

PELOSIA MUSCERDA, HUFN. (Plate XII., Fig. 7).—Of this Puritan-looking little moth the fore wings are reddish-grey, with four tiny distinct black dots toward the outer margin, and two about the centre at the inner margin; the hind wings grey, suffused with rufous. Essentially a marsh species, it is much commoner in northern Europe than in Britain, where it appears to be confined to the New Forest, Sandwich, and the Norfolk Broads. The full-grown hairy larva is rusty black, with a deep black velvety dorsal line, and a reddish-grey interrupted line below the spiracles. It feeds on the lichens of sallows, and on mosses; hibernates, and in May pupates in a double cocoon: the perfect insect, popularly known as the "DOTTED FOOTMAN," appearing in August.

AA. V. SUPER-FAM. NOLIDES.

Fam. Nolidæ.

This is a family of very small moths, *grammatically* well qualified for inclusion among the Micro-lepidoptera. As a representative, *Nola strigula*, Schiff., the "Small Black Arches" (Plate XI., Fig. 1), is decidedly commoner on the Continent than with us, being limited to a few English southern, and East Anglian counties. It is a very dainty little insect: the fore wings grey, marked with dotted black lines strongly accentuated at the bases; the hind wings smoky-grey with lighter fringes. The hibernating larva feeds on oak. It is pale buff, with a yellow dorsal stripe; the body covered with brown tubercles and tufts of hair. It spins for pupation a small boat-shaped cocoon closely approaching in colour the surrounding bark. The perfect insect flies in July, and is common some years in the New Forest.

AA. VI. SUPER-FAM. NYCTEOLIDES.

Fam. Chloëphoridæ.

Earias chlorana, L. (Plate XI., Fig. 2). — Authors are not yet agreed as to the proper place of this family in the scheme of classification; and older writers omit the members of it altogether from their Macro-lepidoptera, placing them with the Tortrices, which, as a moth, one of them, the "Cream-bordered Green Pea," *E. chlorana*, nearly resembles; being only distinguished superficially from the common "Oak Tortrix," *viridana*, by the hind wings, which are white instead of smoky-grey, and certain structural details. Essentially a marshland species, the larva feeds on willow and osier; and, when full fed, is green with brownish dorsal lines. It hibernates as a pupa, and the moth emerges

in May, but is decidedly local, and confined, like the last species, to eastern and southern England. Much larger, and more Noctuid-like, are the "Green Silver Lines," *Hylophila prasinana*, L., a common woodland species, and the rarer southern *H. bicolorana*, Fuessl. The fore wings of the former are clear green marked with oblique stripes of white; the wing edges red-pink, and the green thorax diversified with white chevrons.

AA. VII. SUPER-FAM. NOCTUIDES.

Fam. Noctuidæ.

This is the largest family of British moths of any size, and, as the name implies, they are night-fliers—but not all of them by any means. The Family further resolves itself naturally into five sub-families, of which I shall enumerate some of the most striking genera and species. Normally, the larvæ also are night-feeders, concealing themselves by day; while most, again, pupate under ground. In Germany, as in some parts of rustic England, the Noctuids are known collectively as "Owls," or "Owlets."

Sub-Fam. Acronyctinæ.

Acronycta alni, L. (Plate XIII., Fig. 1).—This is usually accounted a rare moth, and its occurrence in ones and twos is confined to the counties of Yorkshire and of the south. The fore wings are very beautifully dappled; light brown to the outer margin of the discal spot, then black to the kidney-shaped blotch just within the antemarginal border; the apex light greyish; the hind wings snowy white. The larva in its earlier stages decidedly resembles a bird's dropping: later, it is black with a large yellow patch upon each segment, and has the habit of consuming its cast-off skin after each moult. It is sometimes knocked out of

chestnut trees when the boys are collecting "conquerors" in the autumn. It also feeds on alder, and by some is called, therefore, the "ALDER MOTH." The perfect insect appears the following May or June.

ACRONYCTA AURICOMA, F. (Plate XIII., Fig. 2), THE "SCARCE DAGGER," no doubt derives its British name, for what it is worth, from the dark streak at the base of the fore wings about the middle. The more obvious scientific name *auricoma*—the golden-haired—is a compliment to the larva, which after the last moult is bluish-black, each segment containing several bright orange tubercles furnished with golden-yellow silky hairs. It affects oak and bramble, and in England is confined to the south-eastern counties, though abroad it has a wide range this side of the Urals. The mottling of the fore wings of the perfect insect is purplish-grey and white; the hind wings plain, but slightly tawny. It flies in May, and sometimes also in August.

ACRONYCTA MEGACEPHALA, F., THE "POPLAR GREY," is, perhaps, the commonest of the Acronyctas, invading even the "cat-patches" which do duty for gardens in some London suburbs, provided there is a poplar in the neighbourhood. The perfect insect flies all through the summer; it is mottled very much as *auricoma*, but the markings are less pronounced; and the hind wings are white. The larva is greyish, or yellowish-brown, with a curious white or grey-yellow dorsal blotch near to the tail; and it is covered with long hair. It pupates in the autumn.

BRYOPHILA PERLA, F., THE "MARBLED BEAUTY," is a smaller Noctuid: the fore wings white, marbled with various shades of grey, and the stigmata—that is to say, the two parallel markings which have been denominated the reniform and orbicular stigmata (*cp.* Part I., p. 26)—darker grey.

But the moth varies apparently through all the colours of its surroundings; its fixed habit by day being to rest on old walls, where the folded wings assimilate closely the greys, dull drabs, ochres, and greens of the lichens which grow there, and upon which the larva feeds. On yellow lichens it is greenish-grey with a broad dorsal, black-spotted, orange stripe. In this phase it hibernates, and the perfect insect emerges in July and August, extending over the United Kingdom as far north as the Firth of Forth. More local, and confined to the southern and western counties, is the "Marbled Green," *B. muralis*, Forst.: the ground colour of the wings in this case being of varied pale to olive green.

Sub-Fam. Trifinæ.

AGROTIS SEGETUM, SCHIFF. (Plate XIII., Fig. 7).—The larva of this—the "TURNIP MOTH"—is extremely destructive to root crops, feeding gregariously on mangolds, swedes, turnips, etc., though it is not particular as to its diet, and will devour the roots of almost any weed. Like most subterranean feeders it is dingy drab, with faint dorsal and lateral stripes; the segments also "peppered" with black spots. The very common moth is rather variable; but the general tone of the fore wings is warm brown; the usual marks black, but sometimes almost entirely absorbed in the ground colour. It flies everywhere in June.

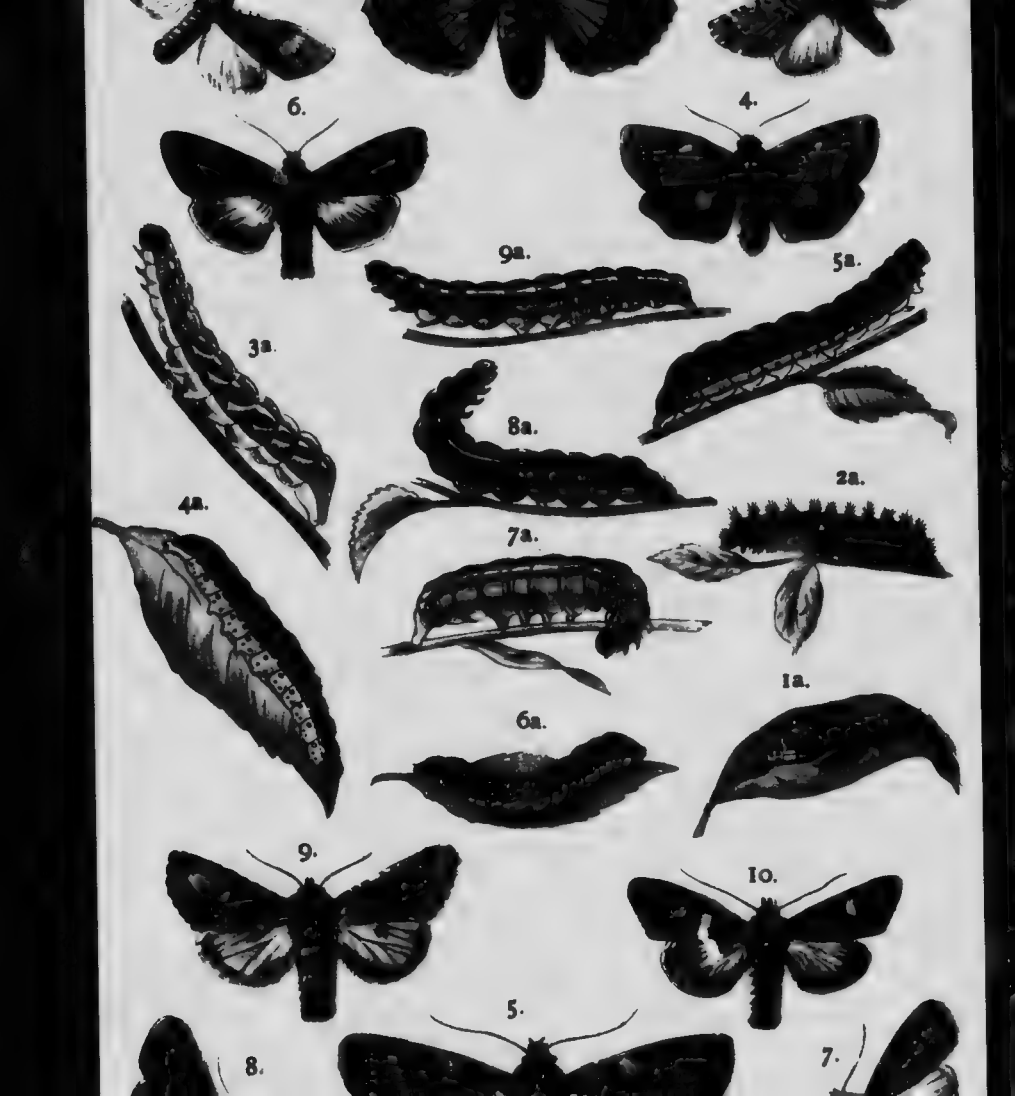
AGROTIS HYPERBOREA, ZETT., THE "NORTHERN DART," is a much more striking *Agrotis:* but it is confined to the mosses and peat hags of northern and western Scotland, and apparently is found occasionally in similar localities in Ireland. The fore wings are extremely variable, but follow the Noctuid pattern with delicate reddish-brown mottling, rather suggestive of the light and shade on the trunk of the

Scotch fi The larva, however, is found on the lowly moorland "grouse berry," *Empetrum nigrum*, and whortle berry from August onwards: the perfect insect, which is supposed to take two years to complete its several phases, flying in June and July; and the female will often lay eggs in the box in which she is held captive.

AGROTIS ASHWORTHII, DBLD., "ASHWORTH'S RUSTIC," is an even more local member of the family, being confined to a few localities among the limestone hills of north Wales. The fore wings are a beautiful dove-coloured grey, marked with black round the orbicular stigma; the hind wings pearly pellucid grey. The larva, which feeds on mountain low-growing herbs, but will take sallow in confinement, is either sage-green or purplish, with a double dorsal line of black, broken by fine bands of green or purple edged with brown. The moth flies in July and August.

NOCTUA BRUNNEA, F. (Plate XIII., Fig. 6), THE "PURPLE CLAY," is a rather more easily distinguished moth than the majority of the "Rustics" with which it is allied. The fore wings are purplish or reddish-brown washed with grey; the reniform designed in ochreous, but variable in the depth and tone of colour. It has also a more handsome larva than the average *Agrotis*, the ground colour, umber to grey-brown, with two parallel dorsal stripes of reddish-brown, punctuated on the middle segments with strong black markings. It feeds on various weeds and low-growing plants; and after the winter will devour birch, etc. The perfect insect emerges in June and July, and may be found in w[illegible]s from the English Channel to the Shetlands.

TRIPHÆNA PRONUBA, L. (Plate XIII., Fig. 5), is the "LARGE YELLOW UNDERWING": certainly one of the very commonest moths at midsummer of the British fauna; careering wildly to the lamps when windows are open, or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seemingly intent on knocking out the equivalent for its brains against the white ceiling! Also variable to a degree, the typical *pronuba* is a large insect with mottled purplish fore wings; the pale yellow hind wings, with a *broad* purplish-brown outer border. The substantial-looking smooth larva varies in tint from black, sage, or yellow-green to grey, with whitish lateral stripes, and a broken double dorsal line of black. I think it will eat almost any living leaf or plant, garden or wild, and all through the winter months it pursues its ravages. The Germans not ineptly call it the "House Mother" from its persistent habit of making our houses the object of its nightly visitations.

TRIPHÆNA FIMBRIA, L. (Plate XIII., Fig. 3), THE "BROAD-BORDERED YELLOW UNDERWING," is another of the group; but the wing colours and markings are generally intensified, the black marginal borders of the hind wings very broad, the ground colour ruddy orange. The burnt-sienna tinted larva has a thin, pale dorsal streak from head to tail; the lower part of the body yellowish, and the whole more or less spotted. While not quite as catholic in its tastes as *pronuba*, it will eat a great variety of plants in autumn and winter, supplemented in the spring by the leaves of sallow, hawthorn, and other trees. It pupates in April or May; and the perfect insect flies in woods and shady places during the two following months as far north as Inverness-shire: and a single female "will lay as many as 1,200 eggs."

TRIPHÆNA IANTHINA, ESP. (Plate XIII., Fig. 4), THE "LESSER BROAD-BORDERED," is a rather smaller "Underwing," with much the same purplish fore wings as the rest of them; but the black marginal border of the hind wings curved, and narrower, with deep purplish suffusion at the bases. The larva, which manifests much the same tastes and habits as those of the previously described species, may

also, like them, be taken by "sweeping" low herbage in the autumn with a stout net, or searching osiers in the spring. When full fed it varies in colour from grey to olive-green, with a faint dorsal line, and black spotting. The moth is not uncommon in the same localities as *fimbria*, flying in July and August.

MAMESTRA PERSICARIÆ, L. (Plate XIII., Fig. 10).—In the group of Noctuids to which the so-called "DOT" belongs are included a host of inconspicuous moths, saddled with some remarkable English names, of which I need only quote the "Glaucous Shears," *M. glauca*, Hb., and the "Stranger," *M. peregrina*, Tr., as incentives to all collectors to master and adopt the as easily-remembered, and decidedly more musical scientific denominations. *Persicariæ*, then, is typical in the ordinary sense, and a very common moth in the south, though the mottled bluish-black fore wings, with the pronounced white reniform, are something of a relief from the more ordinary browns of the genus. The larva when full fed is decidedly pretty, the ground colour varying from grey, with dark green oblique markings on each side of the pale dorsal line, to olive-green, with rows of finely pointed black dashes substituted for the oblique markings. Some larvæ again are purplish with soft brown markings. I have found the former not infrequently on ferns in the conservatory; they will eat, also, marigold, lupin, and other garden plants. They pupate in September, and the moth is on the wing the following July and August, though not common as a rule north of Yorkshire.

HECATERA SERENA, F., THE "BROAD-BARRED WHITE."—This beautiful little moth I have observed frequently in the Piedmontese mountains, sitting by day on grass stems fast asleep, but it is also widely spread from June to August throughout England, and more rarely in Scotland and

Ireland, where it may be attracted by light or to sugar. In typical examples the fore wings are milky white, with a broad central band of purplish including the light-outlined reniform and orbicular spots; the margins of the greyish-white hind wings suffused with soft grey. The larva varies in colour from pale yellowish or bluish-grey, to dark sap-green, with black V-shaped dorsal markings, and thin black lateral stripes. It feeds on the flowers and seeds of hawk's-beard, *Crepis virens*; and, in confinement, on those of the lettuce.

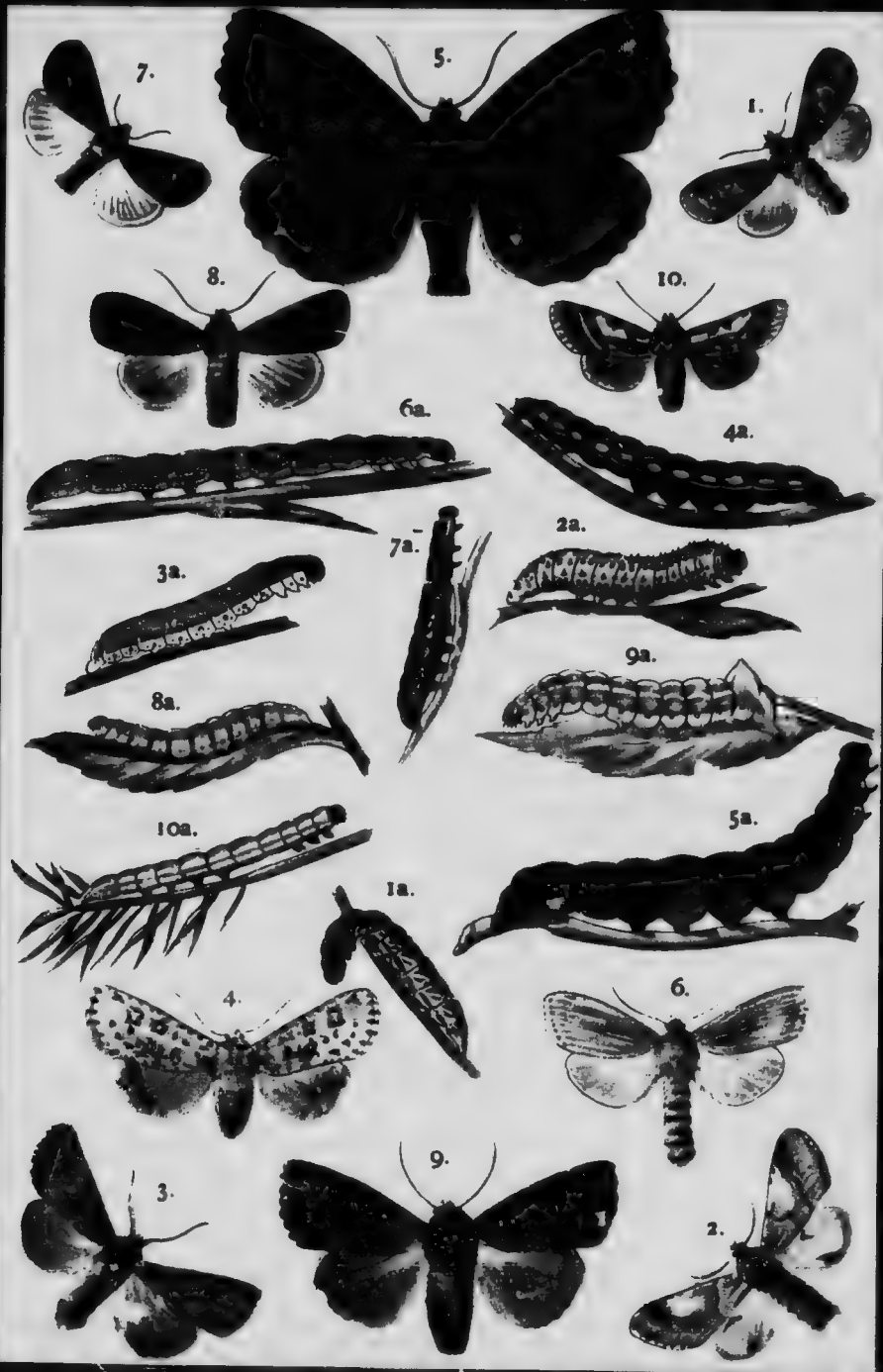
PACHETRA LEUCOPHÆA, VIEW. (Plate XIII., Fig. 9), THE "FEATHERED EAR," is a decidedly local moth in England, being confined to a few localities in the south-eastern counties. The fore wings are dappled with purplish-brown, the two spots outlined clearly in white, and a <-shaped dark mark near the inner margin; the hind wings pearly purple-grey. The perfect insect flies from May to July, and the larvæ have been reared in confinement from eggs laid by a captured female on various kinds of grass. Buckler pictures them after a sixth moult as "much of the colour of Turkey rhubarb, two or three in handsome coats of *feuille de mort* velvet." Dr. Chapman describes them as varying from nankeen-yellow with faint markings, to one with distinct black stripes.

DIANTHŒCIA CAPSINCOLA, HB. (Plate XIV., Fig. 1), a member of the extremely variegated Dianthœcias, is known as the "LYCHNIS," after the bladder campion, one of the several allied plants on which the larva feeds. The moths of this group are distinguished by the lattice-like tracery of the fore wings; in this species, white upon purplish-brown. The larva is ochreous, with a dorsal line of V-marks. As a rule it prefers the seeds for food to the flowers. It pupates in October, and the moth appears in May and June, with an occasional second emergence in September.

CHARÆAS GRAMINIS, L., THE "ANTLER MOTH," derives its English name from the fanciful resemblance of the whitish horizontal line extended about half-way across the ochreous-grey fore wings to the antlers of a deer. The scientific name, however, as is not unusual with the Noctuids, more aptly describes the moth, which in the larval state is sometimes responsible for the wholesale destruction of grass land, feeding from March to June, in fact all through the most critical months for the crops. Fortunately, however, it is much appreciated by birds, and in England, therefore, less of a pest than in those many places on the Continent where all is fowl that comes to the net. When full fed it is bronze-brown with lighter lines; the ventral surface pale golden. I have never come across the perfect insect, which flies in August and September in the southern counties, but on some of the Perthshire moors it is not uncommon, and I have taken occasional examples on the Chilterns.

DILOBA CÆRULEOCEPHALA, L., (Plate XIV., Fig. 2), THE "FIGURE OF EIGHT," derives its name as such from the grey-white 8-mark on the centre of the wings, touching the reniform, but occasionally the two coalesce and the distinction is lost. The larva is sometimes very destructive to the orchard, having a greedy affection for apple in particular, and also to hawthorn hedges, on which it is a rather conspicuous object. It is bluish-grey, with yellow dorsal and lateral stripes, and is also covered with short black bristles. The autumn-laid egg hatches out in March, and the perfect insect, which is often attracted to street-lamps, flies in October and November.

XYLOPHASIA RUREA, F. (Plate XIV., Fig. 3).—The genus *Xylophasia* contains several of the commonest British moths, notably *X. polyodon*, a veritable pest at sugar, and often, in its frantic endeavours to get at the sweet liquid,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driving away species which the collector would infinitely prefer to box. *X. rurea*, the "CLOUDED-BORDERED BRINDLE," is perhaps hardly so abundant: it is an inconspicuous moth, much given to vary in the colour of the fore wings, which are best recognised by a reference to the typical example figured on Plate XIV. The larva is a grass feeder, and almost as variable in tint as the perfect insect, but generally ochreous to blue-grey, black-dotted; with a pale dorsal, and lateral lines of faint brown. The perfect insect flies in June and July, and ranges from one end of the three Kingdoms to the other.

MISELIA OXYCANTHÆ, L., rejoices in the English pseudonym of "EALING'S GLORY," as it was no doubt first observed by the eighteenth century naturalists in what was then the country village of that name. But nowadays we are expected to call it the "GREEN-BRINDLED CRESCENT," since, presumably, the entomological glory has departed from this prosperous villa-suburb. But it well deserved its original old-fashioned title, since the fore wings are remarkable for their green metallic lustre over the umber ground colour; the antemarginal border and light markings pinkish-grey. The larva is brownish-grey mottled green, with a white-marked hump towards the tail; it feeds in the spring on hawthorn, *Cratægus oxycantha*, and other fruit-producing hedge trees; the perfect insect flying in the autumn.

AGRIOPIS APRILINA, L. (Plate XIV., Fig. 4).—Another autumn moth is the lovely "MERVEILLE DU JOUR"—it seems strange that the inventors of names could find no English equivalent! The fore wings have the pale green ground colour marked strongly with black patterning; the spots white interiorly, as also the black-edged antemarginal band: the hind wings soft pinkish-grey. The larva anticipates the perfect insect in colouring, being darkish green

with a white-diamonded dorsal stripe, and sometimes marked obliquely on the segments with black, sometimes with the whole back on each side of the line broadly black; the spiracular region rather lichen-green. Occasionally the pupæ are plentiful in their brittle cocoons at the roots of oak in July and August; the perfect insect coming to sugar applied by preference at the north side of woods, in October.

MORMO MAURA, L. (Plate XIV., Fig. 5), from its demure colour, is known in this country as the "OLD LADY." The fore wings are black-brown, the grey markings rather suggestive of the "watering" of a black silk dress, with grey apical blotches. The large brown larva shows a dark diamond-pattern dorsal line; and the oblique stripes of white are edged with black. It feeds on all sorts of low-growing plants in the autumn, and after hibernation attacks the young leaves of various trees—sallow, birch, etc. The perfect insect flies from July well on into the autumn, and comes to sugar. It is also extremely fond of hiding itself indoors, and is generally common—in some years very common—as far north as the Tay, and in Ireland.

NONAGRIA TYPHÆ, THNBG. (Plate XIV., Fig 6), THE "BULRUSH WAINSCOT," is one of the several "Wainscots" inhabiting our islands. The group, moreover, is of exceptional interest to the naturalist, the moths being usually haunters of marsh and fen; their larvæ feeding inside the stems of reeds, rushes, etc. For the most part the perfect insects are small and inconspicuous: the fore wings of the ochreous colour of old-fashioned wainscoting, I suppose; the hind wings smoky grey, to greenish-fulvous, or dirty white. *Typhæ* is perhaps the largest of them; the fore wings more rufous, and having the appearance of being "grained"; the hind wings rather yellowish-white. The larva is dingy pale brown with a dark narrow dorsal stripe,

and lateral stripes of paler brown. It feeds on the pith of the reed-mace (*Typha latifolia*), in which the eggs are laid, and when full fed in August pupates head downwards in the chamber it has thus hollowed out, about one and a half inches above a hole in the outer rind prepared for the moth, which should emerge the following month.

The larvæ of the "Small Wainscot," *Tapinostola fulva*, Hb., inhabit the stems of sedges; the "Small Rufous," *Cænobia rufa*, Haw., the stems of jointed rush, *Juncus lamprocarpus*; but those of the *Leucania* group, which includes *L. pallens*, L.—the rightly termed "Common Wainscot"—are external feeders on grasses, reeds, etc., and the perfect insects are much larger and stouter bodied.

The Caradrinas, which follow them close in the scheme of Noctuid classification, are also for the most part widely distributed.

CARADRINA MORPHEUS, PALL. (Plate XIV., Fig. 7), THE "MOTTLED RUSTIC," may be taken as representative of the genus—medium-sized moths, with brown mottled wings, traversed by faint lines of darker tint; the hind wings pearly white, showing the neuration. Their larvæ nibble during the winter at dock, dandelion, chickweed, and, in our gardens, horse-radish: that of *morpheus*, however, remaining some time in the winter cocoon before pupation. The perfect insect is on the wing in June, and is generally common.

AMPHIPYRA PYRAMIDEA, L. (Plate XIV., Fig. 9), THE "COPPER UNDERWING," presents an agreeable contrast to the genera of sober-clad moths with which it is grouped. A large insect, the fore wings vary very much in the depth of purplish-black ground colour, with wavy pale transverse lines; the hind wings are uniform flame-colour. The larva, which feeds on oak, rose, etc., is when full fed very

beautiful: the back light green with lateral stripes of yellow and Cambridge blue; but variable in regard to the latter tint. The moth is on the wing from July onwards, and is attracted commonly to light, being most abundant in the southern counties, in some parts of south Ireland, but not occurring in Scotland.

AMPHIPYRA TRAGOPOGINIS, L. (Plate XIV., Fig. 8), is known as the "MOUSE," probably from the greyish mouse-colour of the fore wings, which, except for two small black spots near the centre and an ill-defined dark antemarginal band, are quite plain; the hind wings greyish-white. The larva is rather pretty, being when full fed striped alternately green and white, or occasionally red-brown: it feeds on the usual Noctuid salad of plants—sallow, fennel, strawberry, etc. The perfect insect flies in July and August throughout the three Kingdoms.

PANOLIS PINIPERDA, PANZER (Plate XIV., Fig. 10), THE "PINE BEAUTY," is particularly interesting to students of protective mimicry, inasmuch as the general tint, pattern, and markings of the wings bear a close resemblance to the bark of pine trees, which are the favourite resting places of the moth by day. The fore wings are of the ochreous red-brown associated with the trunks of these trees, and the reniform and orbicular spots are whitish; just as we see the small scarified pieces of bark intermingled like scales in the scheme of colour. The hind wings are dingy smoke-hued. The larva, also, is well protected in the same way when feeding upon the needles of Scotch fir on the outskirts of the plantations, from which it may be beaten in July. It is white with a broad pale green dorsal, and thin green lateral stripes, and a line of pink below the spiracles. It pupates in the bark crevices, or among the moss and débris at the foot of the tree. The perfect moth emerges in March

and April, and, flying by night, is often a visitor to sallow blossom, in the near neighbourhood of fir woods, berberis, etc., throughout the United Kingdom.

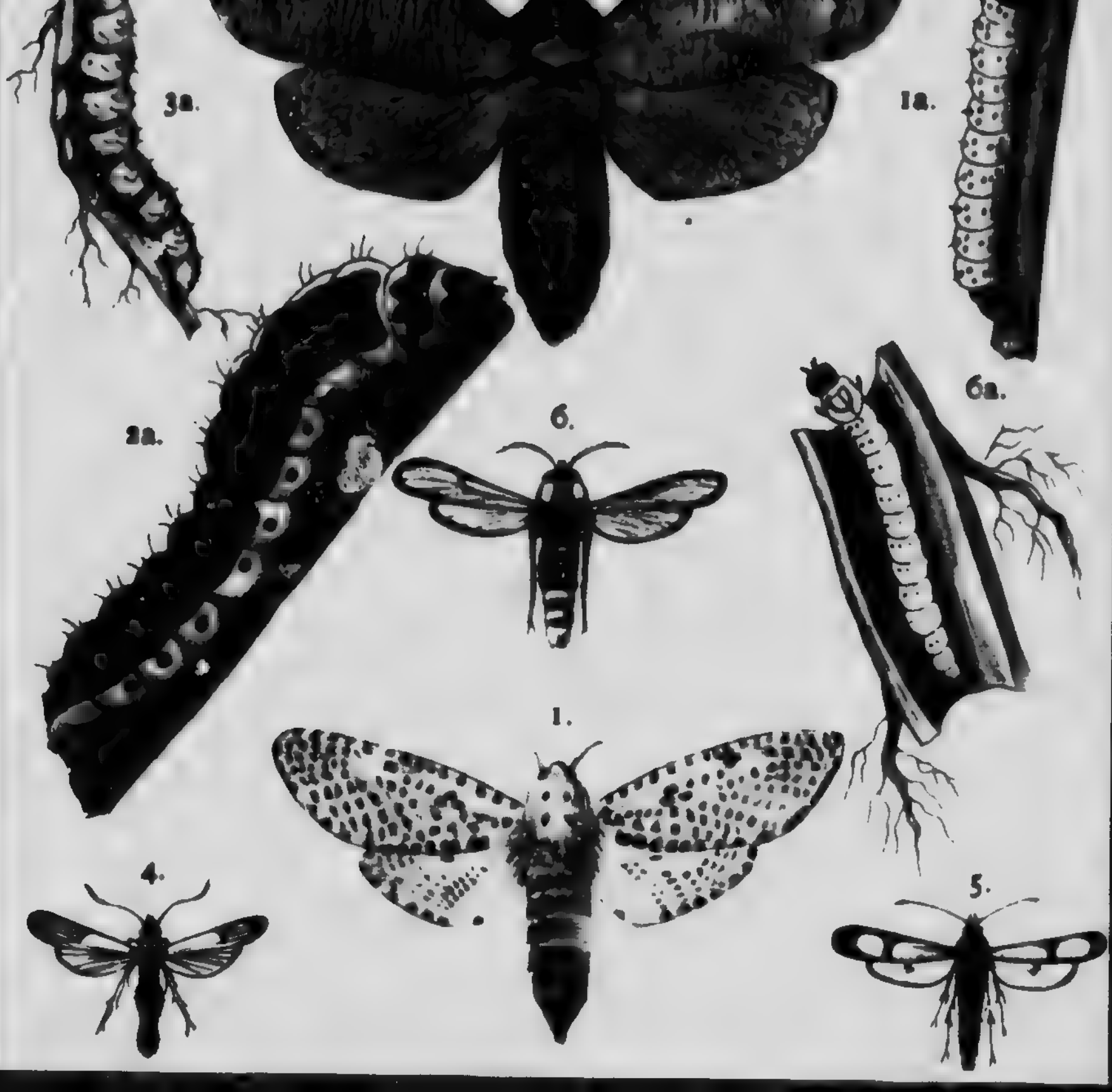
PACHNOBIA RUBRICOSA, F. (Plate XIII., Fig. 8), THE "RED CHESTNUT," will also be of the number thus captured at sallow. It is a handsome moth with strong purplish-chestnut fore wings traversed by three faint lines of the same colour; the orbicular and reniform spots accentuated in pale grey. The larva is also purplish, with a faint dorsal line, and a series of lateral black or red-brown spots centred with white bars on the segments. It feeds upon low-growing plants, dock, groundsel, etc.; and the perfect insect has a decided partiality for blackthorn and plum blossom, as well as for sallow. Its range extends to the Orkneys. *P. leucographa*, Hb., the "White-marked," its congener, is a very much rarer, and local insect, and in Britain does not extend to Scotland.

TÆNIOCAMPA GOTHICA, L.—The *Tæniocampidæ* comprise an interesting group of moths, all of them flying early in the year; in fact as soon as the sallows are golden with bloom: and a mild night at the end of March, or beginning of April, where convenient bushes are situated, will yield invariably a large bag of the commoner species. Among them will be *T. gothica*, which, from the bold black velvety marking of the fore wings, resembling a (to me) unknown letter of some Semitic alphabet, has obtained its cumbrous English name of the "HEBREW CHARACTER." To "work" sallows thoroughly, spread a sheet under the branches, and shake them: the moths will come tumbling down, hopelessly intoxicated with the sweet sugary juices of the willow bloom.

CIRRHIA CITRAGO, L.—The "Sallows," as the group to which *citrago* belongs is affectionately known to collectors, constitute a charming series of Noctuids remarkable for the

brilliant red-browns and ochres of their wings. Some of them are actually sallow feeders in the larval phase, as others when perfect insects visit the early catkins of th "palm" in the warm March and April nights. So that it is by no means unprofitable, if you wish to breed these species, to fill bags full of the sweet-scented blooms on which the young larvæ of the "Pink-barred Sallow," *Xanthia lutea*, Strömi, and of the "Sallow," *Xanthia fulvago*, L., feed, afterwards transferring their attentions to the leaves as well as to a number of low-lying herbs. The "ORANGE SALLOW," *C. citrago*, is, however, a lime feeder, and the eggs are laid in the autumn, so that care must be taken in keeping them to ensure that the larva does not anticipate the leaf-buds of its particular tree. Females of *Xantholeuca croceago*, F., which also visit ivy in October, and sallow after hibernation, may be placed in the spring on oak twigs under muslin bags, where they will lay abundantly: or the larvæ, preparatory to pupation, may be sought in their cocoons at the base of oak trees in June. Those of the "Dusky Lemou Sallow," *Mellinia gilvago*, Esp., about the same time can be beaten from wych-elms, on the seeds of which tree they thrive: all species in this phase presenting a family likeness, but not varying in colour and marking to the same extent as so many Noctuid larvæ.

As for the perfect insects, it is hard to award the palm for beauty; but *Ochrea aurago*, F., the "Barred Sallow," with its fore wings of every shade of yellow from the palest to the deepest orange, and its purple-stained basal and outer marginal bands, is hard to beat. It haunts the beech woods of the Chilterns, as well as those of many other southern and western counties, and, as is the case with the rest of its tribe, appears on the wing at the end of summer,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and well on into the autumn, before lying up among the withered leaves for its winter sleep.

EUPSILIA SATELLITIA, L. (Plate XVI., Fig. 1), THE "SATELLITE," is a very common autumn moth in all parts of the country as far north as Ross-shire, and I have seen it on tree trunks in Middlesex in every winter month on mild nights from November to March. The fore wings are rather red chestnut-brown, distinguished in typical examples by the white reniform; but in some cases this disappears altogether. The larva is black-brown with dark dorsal stripes; and marked with white above the spiracles. It feeds in the early summer on beech, elm, etc., and also low-lying weeds. It is, indeed, omnivorous; and, when accidentally introduced into the breeding-cages with the larvæ of other species, will sometimes make a meal of them all; the specimen figured by Buckler in his great work "On the Larvæ of British Moths" had disposed of fifty-seven victims in the fortnight previous to the painting of its portrait!

Another favourite group of Noctuids is the "Sharks," that is to say the genus *Cucullia*, which comprises some of our very rarest moths, and the most difficult to come by in Nature, owing to their extremely local habits, the rarity of the plants on which they feed, or the retiring habit of the perfect insect.

CUCULLIA VERBASCI, L., THE "MULLEIN SHARK," is, however, one of those species which are often extremely common in the earlier phases, though the moth itself apparently is impervious to the attractions of light and sugar, and, therefore, seldom captured "wild." The larvæ, which I have found abundantly in our Middlesex gardens feeding on various sorts of mullein, are extremely handsome; blue-green or bluish-white, banded with orange or pale yellow, and marked with large black spots on all the

segments: and, no doubt because of their conspicuous colouring, they are terribly infested with ichneumons. They sometimes remain in the pupal phase a couple of years, the perfect insect appearing eventually in May and June. The outer margins of all the wings are dentated sharply; the colour of the fore wings umber-brown, with a deep dark brown stripe broadening from near the base of the inner to the outer margin, in what I conclude to be the shape of the shark's tooth.

The rarest of the Cucullias, *C. artemisiæ*, Hufn. (Plate XVI., Fig. 2)—which can hardly be claimed as a British insect—*C. absinthii*, L., and *C. gnaphalii*, Hb., feed on plants which provide them with English names—viz., wormwood, and cudweed.

ANARTA MYRTILLI, L.—This lovely little moth is deservedly called the "BEAUTIFUL YELLOW UNDERWING," though of course it is no relation to the large stout-bodied moths which have been described already in the "Yellow Underwing" category. Unlike them it is a day-flier, delighting from April to August in the warm sunshine of commons and moors throughout the country, where it may be seen flying over the heather. The fore wings are mottled purple-brown with a distinct white centre spot; the hind wings bright yellow with a broad black border. The larva feeds on ling and heath; it is got by "sweeping" as late as October in the north, and when full fed is green of the heather tint, with two criss-cross purplish lines on each side of the back. Commoner still, and a denizen of the hay-fields in May, is the somewhat similar "Small Yellow Underwing," *Heliaca tenebrata*, Sc.

Sub-Fam. Gonopterinæ.

Of this sub-family we have but a single British representative, picturesquely called the "HERALD MOTH," *Scolio-*

pteryx libatrix, L., and quite unmistakable with its deeply dentated fore wings, rich orange basal markings, and the whitish central bands. The thorax is also a beautiful orange-red. Towards the beginning of November it comes into houses or other warm retreats to hibernate, having patronised the earlier ivy bloom. The larva, when full grown, is long and taper ; brilliant green with occasional red spots below the thin dark spiracular line. It feeds on sallow, osier, etc. ; and the perfect insect is not uncommon throughout the United Kingdom.

Sub-Fam. Quadrifinæ.

This next sub-family contains the most varied and attractive Noctuid genera ; first and foremost of them the "Plusias" ; then the "Red Underwings."

PLUSIA GAMMA, L. (Plate XVI., Fig. 3), the familiar "SILVER Y," is the commonest of its kind, and in some years its numbers are augmented by vast migrations from the Continent, my own observations tending to connect them in some way with similar flights of the "Painted Lady" ; for in the years when the butterfly is commonest this Plusia is often also abundant. Ordinarily the fore wings are marked with deep velvet-black on purplish-grey—the Y white and obvious ; the grey hind wings with a deep suffused inky-grey border. The larva, covered with isolated hairs rather like those on the leaf of a stinging nettle, varies from pale yellow with grey stripes, to vivid green, and feeds on wild and garden plants of all kinds. It spins a white silky cocoon in which it pupates cradle-fashion, as is the custom with all the race : the latest addition to the British List—*P. moneta*, F., which from an occasional immigrant has established itself in many southern and Midland gardens where aconite and delphinium are cultivated—sometimes varying the white

with a golden cocoon. At first accounted a great rarity, it is now well represented in most collections; and for the past fifteen years a single aconite plant in a Middlesex garden has furnished an abundant supply of the grass-green larvæ. But curiously enough, though I have bred at least a hundred moths from them, I have never seen the "Golden Gamma" upon the wing in June and July, which are the months of its emergence. Others of the Plusiid race, like the "Burnished Brass," *P. chrysitis*, L., have the upper wings almost covered with brilliant metallic bronze: or, as in *P. bractea*, F., the "Gold Spangle," they display two central and an apical blotch of the same metallic quality. All of them fly to flowers at dusk; and valerian is regarded as their special favourite.

EUCLIDIA MI, CL., THE "MOTHER SHIPTON," and *E. glyphica*, L., are two extremely graceful little Noctuids which fly by day in grassy June meadows and on down-sides. The former got its odd name from Moses Harris, one of our earliest British writers, who with considerable cleverness, seeing that the famous prophetess had been dead a couple of hundred years before he named the moth, thought he detected the features of the then much reverenced old lady outlined in the ochre-grey and black-netted wings of *Euclidia mi*. The Burnet, *E. glyphica*, L., is rather like a small "Yellow Underwing"; the fore wings marbled purplish-grey, with transverse velvety bands; the hind wings orange-yellow, with a deep purplish suffusion at the base. I see Mr. South calls it the "Burnet Companion," for though it is obvious that this moth has no sort of connection with the Anthrocerid Burnets (*see* p. 257), it is taken not infrequently in the localities they frequent. But it might just as well have been christened "Mother Shipton's" familiar spirit! Indeed, the larvæ of *mi* and *glyphica*, pale

yellow with grey stripes, resemble one another closely enough to justify the title.

PSEUDOPHIA LUNARIS, SCHIFF. (Plate XVI., Fig. 4), THE "LUNAR DOUBLE STRIPE," cannot be regarded as a British insect. A few isolated specimens are taken from time to time, mostly in the south-eastern or eastern English counties, after obviously successful sea passages, when they succumb to the attractions of cane sugar. But the larva has never been found here, nor is it likely to be.

CATOCALA ELECTA, BKH. (Plate XVI., Fig. 6).—What I have written about *P. lunaris* applies as well to this species, but two examples constituting the British record. It has, however, a strong likeness to our common "Red Underwing," *C. nupta*, L.; the grey fore wings being traversed by less regularly designed umber markings, and the reniform spot less distinctly separated from the surrounding grey. Both species display broad black margins to the crimson hind wings; but in *nupta* the band is less regular, while the central broken band of black is less curved in the middle. Our own "Red Underwing" lays its eggs on the bark of poplars and willows in the autumn; the larvæ emerging in spring. They hide in the crevices by day and ascend the tree to feed by night. When full fed, with their rough brown skins marked and "crusted" with the same colour, they are extremely difficult to separate from the chips of bark in which they conceal themselves, and among which they eventually pupate. I generally find the bottles of stale beer, hung on the walls for wasp traps, tenanted by one or two of these splendid moths in August; while by day in Middlesex they are common at rest upon palings. But their range is confined principally to the south and east, and captures reported elsewhere must be regarded as accidental.

CATOCALA SPONSA, L. (Plate XVI., Fig. 5), THE "DARK

CRIMSON UNDERWING," is perhaps the handsomest of the British members of the genus. The crimson red is intensified: the fore wings are mottled browner, and darker than in *C. nupta;* the central yellowish-white blotch distinct and pronounced. But though it is an occasional visitor to counties just north of the Thames, its headquarters in England is that paradise of the British entomologist—the New Forest, where in some years it is abundant at sugar in July and August. The larva hatches with the budding of the oak, and when full fed varies from light sienna, striped with brown and ochre, to black-brown; each segment covered with pale warty spots, and the dorsal area spinous. In June it spins a loose hammock-like cocoon in which it pupates. A captive female will often lay her eggs on oak twigs.

CATOCALA FULMINEA, Sc. (Plate XV., Fig. 7), though found in most countries of central Europe, is not indigenous to Britain or Holland. It is distinguished from our "Underwings" of the genus by the smaller size, and the substitution of pale gold for the red or crimson hind wings.

Sub-Fam. Hypeninæ.

This sub-family includes a number of small, rather Geometer-looking moths with thin bodies and delicate wings, originally classed with the Pyralids (*cp.* p. 222), but latterly transferred to the Noctuids. In this country the two principal groups are known as the "Fan-Foots," and the "Snouts": the former descriptive of the peculiar fan-like front pair of feet in the perfect insect; the latter of their long palpi, a good example of this characteristic being found in the "Snout," *Hypena proboscidalis,* L., sometimes very common in nettle-infested ditches in the summer. This peculiarity, also, establishes that very

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rare and extraordinary moth *Parascotia fuliginaria*, L., the "Waved Black," in the same category. For a curious little black insect it is: the larvæ feeding on soot-begrimed fungus in damp London riverside tenements, and the majority of specimens captured haunting the same gloomy purlieus.

AA. VIII. SUPER-FAM. NOTODONTIDES.

Fam. Notodontidæ.

This family includes the many moths known collectively as "Pusses" and "Prominents," and is notable, among other things, for the curious shape and appearance of the larvæ, the most grotesque of them all being the lobster-like *Stauropus fagi*, L., which is supposed, when seen front-on, to mimic a spider, and thus to scare away the predatory ichneumon with much waving of its odd thin legs (*cp.* Part I., p. 73). Of the hundred or so Notodontids known to science as inhabiting Europe, a quarter at least have been found in the British Isles.

As it is necessary, from considerations of space, in this part of the book to condense the accounts of our British moths as much as possible consistently, I hope, with clearness, I shall attempt to sketch at most a very few representatives of each remaining sub-family and genus. The "Kittens" and the "Puss Moths" are cases in point. We have three of the former—the "Alder," "Poplar," and "Sallow" Kitten respectively—*Cerura bicuspis*, Bkh., *C. bifida*, Hb., and *C. furcula*, Cl.; the first decidedly rare, and confined to a few English counties, chiefly north-Midland; the second (Plate IX., Fig. 3) with a wider range; the third well distributed in all three Kingdoms.

Dicranura vinula, L. (Plate IX., Fig. 2), the "Puss Moth," derives its name from the grey-speckled, furry-

looking wings of the perfect insect, and its soft grey-silvered body. The eggs are laid on poplar. The full-fed larva, as already mentioned, has a decidedly "horrific" appearance, with a sort of green camel's hump behind the head, and the waving tentacles shot out and withdrawn from the "tails," which really take the place of a pair of claspers. The body is brilliant apple-green, with a dorsal stripe and saddle of purplish-black, margined with white. It constructs, with the aid of a strong glutinous secretion, a cocoon of bark and wood shreds, which soon hardens into an effective protection for the contained pupa. In this phase it winters; and in the following May the moth emerges, its exit being facilitated by the head armour of the pupa ramming the weakest part of the cocoon, and, as soon as the breach is prepared, the outgoing moth lubricating it with a special ejected fluid until it gives way.

A very easy and interesting insect to rear and observe, *D. vinula*, ranges more or less commonly over the whole of the United Kingdom. But my experience is that in Nature it is best looked for when at rest; for it seldom patronises light, and is infrequent at sugar.

As stated, STAUROPUS FAGI, L., THE "LOBSTER MOTH," is so called from the shape of its larva, which may be beaten from beech trees occasionally in the great Chiltern woods; and more rarely in the New Forest and some Midland beech-areas. The time for search is the summer from July to September: the full-fed larva spins up a tough cocoon for pupation: the perfect insect, which is heavily "feathered" with greyish-brown, making its appearance in May or June.

In France the larva has achieved for it the name of the "Squirrel."

EXÆRETA ULMI, SCHIFF. (Plate IX., Fig. 1), is a rare moth of central and southern Europe: the fore wings

dappled grey, with a broken antemarginal row of white spots; the hind wings white with a thin grey marginal line and white fringes. The larva (Fig. 1*a*) feeds on various species of elm.

THE PROMINENTS are a favourite group with collectors. They derive their name from the raised mass of scales which is prominent at the inner margin of the fore wings of the perfect insects. Some are extremely rare in this country, for example *Notodonta tritophus*, whose claim to be British is based on a single capture in Norfolk about thirty years back. Others are unusual, and very few common.

NOTODONTA ZICZAC, L., (Plate IX., Fig. 4), THE "PEBBLE PROMINENT," owes its scientific name to the very odd appearance of its larva, which is whitish-grey with a broad dark dorsal line, and yellowish lateral streaks: a series of "camel's" humps along the back, the anal segments ochreous and also humped pyramidically, give it an exceptionally grotesque aspect (Fig. 4*a*). It feeds upon willow and sallow, and pupates in the earth at the foot of the tree, where it is best looked for early in the autumn. For burrowing larvæ, as soon as they pupate, are apt to fall victims to the mice and other small creatures which rely upon such things for winter pabulum. There are two, and sometimes, as in the hot summer of 1911, three broods of the perfect insect: the first in May or June, the second in August: the fore wings pale ochreous brown, darker at the wing bases, and the apex marbled.

PTEROSTOMA PALPINA, L., THE "PALE PROMINENT," is also widely distributed, and comes to light, sometimes freely, in May, June, and August, for it is also double-brooded. I have often netted it in the Home Counties late in the evening from an open window as it sailed towards the lamp, or boxed it resting on a street lamp. The larvæ of

this group of Notodontids, however, are not characterised by a humpy appearance. They are for the most part smooth and shapely; that of *palpina* rather transparent bluish-green, with dorsal stripes of white, and a widish lateral stripe of primrose edged with red-black. It feeds on poplar and sallow, and spins for pupation a cocoon in the débris at the foot of the tree trunk.

PHEOSIA DICTÆOIDES, ESP.—The larva of the so-called "LESSER SWALLOW PROMINENT" is also smooth and purplish, with a broad yellow spiracular stripe, and purple-black blotches over the spiracles. The moth, which is a smaller edition of *P. tremula*, Cl., the "Swallow Prominent," is brownish-white with purple apex to the wings and a heavy purplish-brown stain along the inner margin; the hind wings almost pearly white. Both species are poplar feeders, and in September I have found *dictæoides* not uncommonly on the white-poplars which fringe the mountain tarns of the Perthshire moors. All the "Prominents," however, are best collected by rearing from the egg; captured females as a rule being ready enough to oblige, if placed upon a freshly cut spray from the tree on which the larva feeds.

PHALERA BUCEPHALA, L. (Plate IX., Fig. 5), the familiar "BUFF TIP"—or, as the Germans more poetically style it, the "Moon Bird"—is a species which at rest is singularly difficult to separate from its surroundings, but being a lamp-lover by night is therefore easy of capture. Nor are the gregarious larvæ, with their truly catholic taste for nearly every tree, difficult to come by. I have found them repeatedly in September enjoying the "Penzance Briars"; and they are, when full fed, velvety yellow, marked with black lines, and rather hairy. The moth, as figured, presents a lovely combination of purplish-browns and greys on the fore wings, with the "buff tips" well accentuated; the

hind wings spotless creamy white. *Bucephala* flies in June and July throughout the entire kingdom, even in the gardens of the most overbuilt suburbs.

To this group also belong the "Chocolate Tips," of which three are counted British, one, the "Small Chocolate Tip," *Pygæra anachoreta*, F., being preserved insular by continuous breeding from wild females taken originally on the coast of Kent.

A. IX. SUPER-FAM. COSSIDES.

Fam. Cossidæ.

Cossus cossus, L., the "Goat Moth" (Plate XV., Fig. 2), owes its name to the peculiar "goaty" smell of the larva, which is a destructive borer in the trunks of oak, willow, and elm. Developing slowly—it takes certainly two years to complete the larval phase—it is, when full fed, of a colour rather suggestive of raw frozen meat; reddish on the back, the lower part of the body whitish-yellow. I have come across it not infrequently in country lanes lying helpless on the ground after a touch of frost, when disturbed from its galleries. Its masticatory powers are enormous, and it will eat through an ordinary wooden box (there are wonderful tales too of perforated lead covers) in a night. It pupates in the earth, and the great grey-speckled moth—the female twice as large as the male—with wings rather reminiscent of the knotty surface of cork bark, is more or less common from Land's End to the Hebrides in the summer months. Having a pronounced tendency to grease, the body should be carefully cut from the thorax, the contents removed, and the void filled with cotton wool. It can then be replaced with a little shellac or gum arabic. The Germans call it the "Willow Borer."

A. X. SUPER-FAM. TORTRICIDES.

Fam. Tortricidæ.

The number of moths included in the Tortrices for the Palæarctic Region—roughly from the Atlantic to the Pacific, and north of Sahara through Persia and north of the Himalayas—is about 1,900; and of these something over 300 occur in the United Kingdom, the family being thus numerically the largest of our entire list. Their relatively small size, however, and perhaps a certain sameness in the earlier phases, has caused them, and indeed the whole of the Microlepidoptera, to be neglected somewhat. But this much may be said for them, that they offer a wide field for exploration to the keen naturalist, and such exploration, diligently pursued, holds out a better chance for the discovery of new species than in any other group, except that perhaps of the stil' smaller, and less studied *Tineidæ*.

With the small space at my disposal, it is, of course, out of the question more than to graze the subject. The family is divided up into three sub-families: (1) *Tortricinæ*, (2) *Conchylinæ*, and (3) *Oleutherinæ*: and I shall describe a representative of each. I may say, however, that there are certain characteristics of egg, larva, and pupa common to the whole group. The eggs are flat, and laid in masses overlapping each other, as we see the tiles on a roof, and the Tortrix larva is at once distinguishable by its habit of leaf-rolling and shoot-twisting, the process beginning with the spinning of a light web *across* the object. This hardens and contracts, and the leaf ends are drawn together, forming the familiar habitation on roses, oak, and all the trees and shrubs which are the particular care of the several species. Others burrow into our orchard fruits, beech mast, and seeds; while the pupa is contained in a silk cocoon.

Description of Genera and Species

Sub-Fam. Tortricinæ.

TORTRIX VIRIDANA, L. (Plate XVIII., Fig. 9), THE "GREEN OAK MOTH," is the little moth whose larva in early spring often reduces whole forests to a state of leaflessness, when otherwise the oaks would be in all the glory of their first fresh foliage. Nor is its attention always devoted to the same tree, aspen and beech being also devastated. When full fed in early June it is extremely active, and when alarmed slips out of its hiding place, and swings at the end of a silken thread; mounting again as soon as the danger is past. Its colour is bright green; the hind segments yellowish-green dotted with tiny black spots: and protected by a white web of silk it changes into a chestnut-brown pupa within the rolled leaf. The fore wings of the perfect insect are apple-green, edged on the costa with sulphur-yellow; the hind wings smoky lustrous grey; and at dusk it may be seen on warm evenings hovering in swarms above the oak trees. It is all too common in Ireland, and Britain as far north as the Firth of Forth.

Sub-Fam. Conchylinæ.

CONCHYLIS FRANCILLONANA, WALSINGHAM.—This moth belongs to the smaller of the three Tortrix sub-families, and is quite one of the prettiest of all the species contained in it. The fore wings are pale yellow, with two dark red-brown bands, and the costal edge rusty red; the hind wings are pale grey, heavily fringed. The larva, which is whitish-yellow with a black head, feeds in the seed of wild carrot during the autumn, and pupates in the stems during January, February, and March; the small holes pierced by the occupant, when it retires to change, betraying its presence. The perfect insect flies in July and August; and, though not generally common as far north as Lancashire, is abundant

locally, as in the Warren at Folkestone, and occasionally in parts of south Ireland.

Sub-Fam. Oleutherinæ.

CARPOCAPSA POMONELLA, L. (Plate XVIII., Fig. 10).—Whereas the majority of the Tortrices are leaf-rollers, there are several exceptions to the rule; notably some members of the last sub-family which feed on the seeds, or mine the stems of their food plants; and the genus *Carpocapsa*, whose larvæ are exceptionally destructive to fruit—apples, plums, acorns, and chestnuts: another tiny pest, *Endopia nigricana*, Stephens (=*pisana*), having a fancy for peas in the pod. *C. pomonella*, as its name implies, in the larval phase, indulges a taste for green apples and pears. When full fed it is a maggoty-looking creature, pinkish-yellow with a pale brown head, but with the fall of the fruit, which it brings about as soon as it attacks the pips in October, it has finished feeding, and comes out to spin a cocoon in the crevices of the bark, and in the following spring to pupate without further depredations. The perfect insect emerges in June and July, and is extremely handsome. The fore wings are umber brown coronated whitish-grey, with a glossy chestnut patch towards the apex containing an ocellus edged with lustrous metallic-copper; the hind wings golden-brown, darker at the margin. *Pomonella* is one of those insects which, being once introduced into a country, however distant, however different from their native northern hemisphere, speedily acclimatise; and wherever the apple has been cultivated, in New Zealand, in Australia, and in Tasmania, it has become firmly established, while its distribution in the United Kingdom only stops where the orchard ceases to be productive.

Description of Genera and Species

A. XI. SUPER-FAM. ZEUZERIDES.

Fam. Zeuzeridæ.

Sub-Fam. Zeuzerinæ.

Zeuzera pyrina, L. (Plate XV., Fig. 1), **the "Leopard Moth,"** is another extremely destructive wood-borer, choosing pear trees, as a rule, for its depredations, in which sometimes the larva occupies three years. When ready for pupation it is whitish, barred with ochreous rings, and an ochreous dorsal line; two black blotches immediately behind the head; a black dot on all the segments. It spins a cocoon for hibernation, and finally another, composed of silk and wood chips, for pupation. The perfect insect is to be found even in our suburban gardens, the leopard-spotted fore wings at once distinguishing it from other moths; while it will be seen that the female possesses a long "tail-piece," which she inserts under the bark surface to deposit her eggs. The perfect insect flies in June, but does not appear to occur north of Cheshire, or in the western counties.

A. XII. SUPER-FAM. HEPIALIDES.

Fam. Hepialidæ.

Owing to the primitive structure of these insects in their several phases — commonly denominated the "Swifts" by reason of their curious, rapid, erratic flight— they have been relegated to the very lowest place in the systematic scale of classification—a position, in fact, which they share with the "Micros." We have but five species in Britain; but in Australia, where the moths attain gigantic proportions, they are largely represented. The larvæ live either at the roots of plants or in the trunks of trees, and are very grub-like; while the soft, almost unarmoured, pupa is very lively and active, resembling the immature phase

of the "daddy long-legs." The females apparently scatter their eggs broadcast, and lay an incredible number; indeed, when recently hunting *Hepialus alticola*, Obthr., in the Pyrenees—a species which has an entirely wingless female—I have found the whole floor of the containing pill-box literally strewn with them like loose gunpowder.

HEPIALUS HUMULI, L. (Plate XV., Fig. 3), the familiar "GHOST MOTH," is so called from the satin-white of the wings of the male, the female being marked with tawny yellow on the fore wings, and the hind wings smoky black. But in the far North, where both sexes are also much larger (=var. *thulensis*, Newman), the male is pretty much the same colour as the female. The male attracts the female by hovering motionless over the ditches and grass-grown banks where she may happen to be. The plain, unattractive, dirty-brown larva devours the roots of many weeds—dock, dandelion, etc.—through the winter to May, and the perfect insect appears about midsummer. In France it is known as the "Hop Hepialid" by reason of the larva feeding on the roots of the hop-vine.

HEPIALUS LUPULINA, L., THE "COMMON SWIFT," is much smaller than the preceding and rather variable, most examples, however, displaying more or less broken patches of white upon the otherwise uniform brown wings. The larva is extremely destructive to the roots of grass, feeding through the winter to April; and the moth is abundant everywhere in June.

B. I. SUPER-FAM. GEOMETRIDES.

The Geometers in many ways approach nearer to the butterflies than to the Noctuids and other moths which I have described in the preceding pages. Generally speaking, they are fragile in appearance; the texture of the wings

is altogether lighter, and the flight less sustained; the bodies are thinner and nipped in beneath the thorax; while the antennæ of many of the genera are taper and thread-like, in contradistinction to the highly elaborate pectinated antennæ of many non-Noctuid Heterocera.

It is, however, in their larvæ that we find the principal structural differences and peculiarities of shape and methods which constitute them a super-family apart. The Geometer larva, as its name implies, has a curious habit of *measuring* apparently the distance it is about to cover. In nearly every case the normal triple set of claspers is reduced to two, and, grasping firmly the surface of the earth or other substance on which it is, it rears itself up straight and rigid on its hind "legs," swaying to and fro as though to take stock of its surroundings. When it does proceed to move forward, the claspers are drawn up to the true legs, the body thus forming the familiar loop—from which gymnastic it derives the name of "Looper."

The usual method of collecting the perfect insects is by soundly belabouring the hedges and bushes in which they take refuge by day, and netting them as they "break covert." Numbers may also be taken from their resting places on fences, walls, tree-trunks, etc., as soon as the eye is trained to separate them from their roosts, the wing patterns often reproducing with marvellous fidelity the tints and surface markings of their environment. As night-fliers they are more numerous at light than at sugar; while on dull days, when butterflies cannot be induced to rise by kicking or beating the herbage, Geometers will be found more amenable to boot and stick, many species even selecting the cool grey light of a sunless day for flight. In the far North, on the mosses of Arctic Norway and in the green birch forests of Lapland, I have made quite a bag of them, when

eight hours' consecutive work has failed to produce a single butterfly!

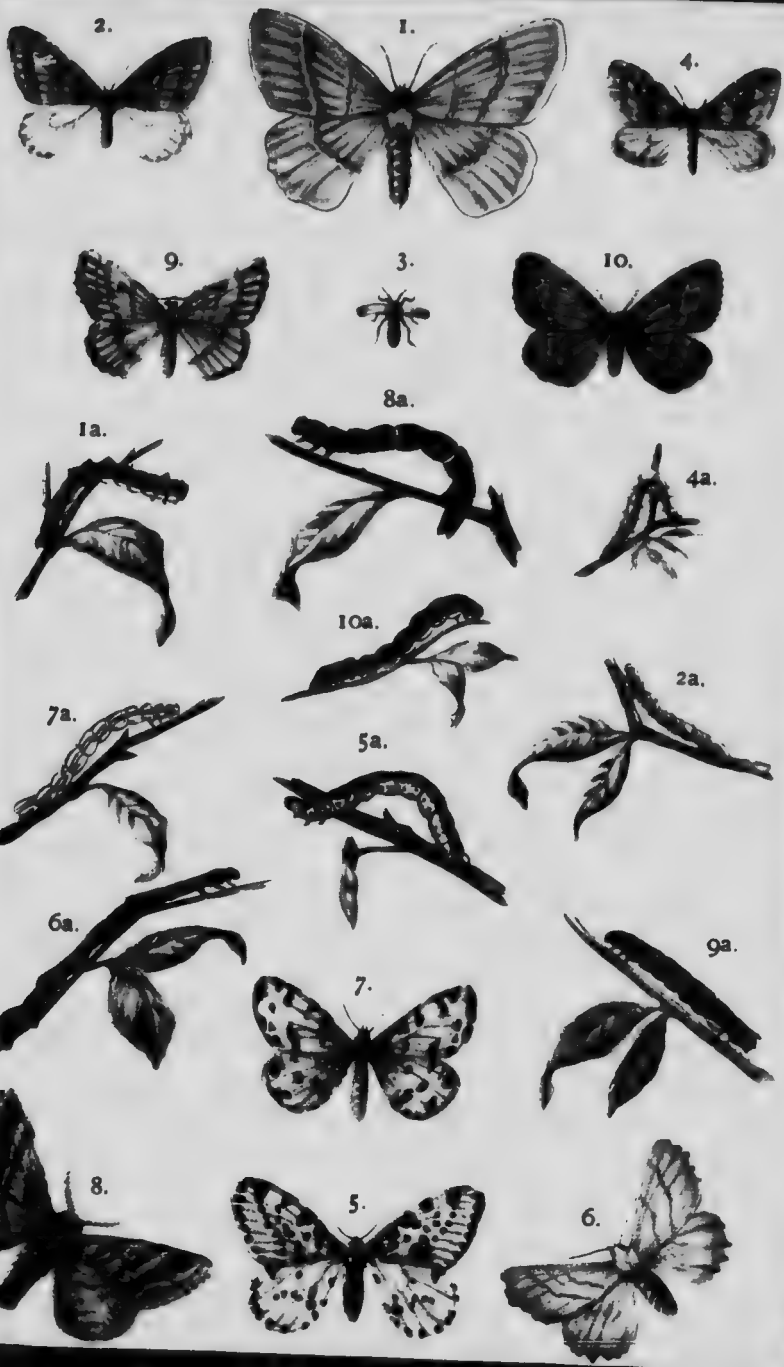
Fam. Geometridæ.

Sub-Fam. Geometrinæ.

In this division is included that lovely race of moths which we know as the "Emeralds," distinguished by the exquisite green of their wings, ranging from the deep emerald of *Geometra papilionaria*, through the vivid brilliancy of *Euchloris smaragdaria*, to the faint anæmic tints of *Iodis lactearia*. But whether dark, medium, or light, the green hue is extremely fugitive, and even when shut carefully in the cabinet, unexposed to light, it quickly fades to white.

Pseudoterpna pruinata, Hufn., the "Grass Emerald," is grey-green, with white fringes and wavy dark lines on all the wings. The larva, which feeds on various kinds of *genista*, hibernates. It is green, with a triple dorsal line—the middle one dark green, the other two white; while lower down there is a lateral pink stripe. It hibernates in this phase, and the moths are fairly common in June and July on heaths and commons as far north as Perthshire.

Geometra papilionaria, L. (Plate XVII., Fig. 1), the "Large Emerald," is the largest of the British "Emeralds." All the wings of fresh examples are deep green, the wavy transverse lines lunulated, but occasionally wanting entirely. The larvæ after hibernation may be beaten from birch in late March and April, or collected from among the green catkins they closely mimic in colour and shape. The green pupa, shaded buff, and spun up among the leaves in June, is also extremely difficult to detect; but the perfect insect is common enough in most parts of the country, flying round the birch trees for an hour before midnight. It comes, also, freely to light.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GEOMETRA VERNARIA, HB., THE "SMALL EMERALD," is a paler green than *papilionaria*, the white transverse wavy line well defined and white. The eggs are laid on the rind, never on the leaf, of the "traveller's joy," *Clematis vitalba*, one above the other in piles of twelve to fourteen. The larvæ when hibernating are exactly the colour of the dead clematis stem; in the spring they moult to green, the head and legs purple-brown. The green pupa is suspended by the tail butterfly-fashion; and the moth emerges in July and August, frequenting chalk downs, but not ranging north of Worcestershire.

EUCHLORIS PUSTULATA, HUFN., THE "BLOTCHED EMERALD."—In this "Emerald" the wings are vivid green, with blotches of white, stained red toward the lower part of the outer margin, the margins themselves chequered white and red. The hibernated brown larvæ may be beaten from the oak in spring, and in all their stages have a remarkable talent for clothing themselves with atoms of leaf, so as to heighten the protective resemblance to their pabulum. The flight of the perfect insect takes place at sunset, high up among the oak trees; but it is more easily netted during the day by beating the lower trees that border the sides of woods, and in this way I used to take it not uncommonly in the woods between Rugby and Coventry, though it is accounted something of a rarity outside the southern and eastern area.

EUCHLORIS SMARAGDARIA, F., THE "ESSEX EMERALD."—The tailor instinct, so strongly developed in *pustulata*, is even more marked in the larva of this species. The moth, which is a richer green, with the hind wings shaded white from the costal margin, lays its eggs on sea-wormwood, *Artemisia maritima*, and the young larva swathes itself in fragments of the woolly food plant, in which garment it hibernates, renewing the process in the spring; and until

full fed in June it is so densely clothed with dead bits of *artemisia* as to be practically indistinguishable. It must always have a fine constitution, as the tides not infrequently cover the salt-marshes and submerge the plants growing on them. *Smaragdaria*, however, in captivity, will eat "lad's-love," otherwise southernwood; and the moth, which is confined to the Essex marshes, emerges in mid-July.

To this genus also belong the "Little Emerald," *Iodis lactearia*, L., which is so pale a green as to be almost white; and the "Common Emerald," *Hemithea strigata*, Hb., darker again with chequered fringes, and the slim green larva V-marked on the back.

Sub-Fam. Acidaliinæ.

This sub-family contains the group of small Geometers popularly known as the "Waves," from the waved lines, which are more or less marked, on the upper wings of most of its members.

HYRIA MURICATA, HUFN., Newman's "GOLDEN-BORDERED PURPLE," as a matter of fact has two forms: one, roughly speaking, with gold-yellow wings, bordered with reddish-purple—the usual Southern form; the other, in which the purple pervades the wings to the exclusion of the gold. It is an extremely delicate little insect, and very local, flying in the sunshine down the grassy rides of the New Forest, and, again, farther north, affecting the moorlands of Witherslack and Rannoch.

Of the genus *Acidalia* not less than a hundred and eighty species are credited to the Palæarctic regions; while at least twenty-six have been recorded in the British Islands. Some of them are extremely local, and some extremely rare—as, for example, the "Rusty Wave," *A. herbariata*, F., which has been observed only in London, not a dozen in

all; and as Guenée, the great French lepidopterist, associates it entirely with the shops of herbalists and druggists, we must conclude that the "Rusty Wave" is no more than a casual visitor. The taste for dried or decayed vegetable matter is not confined, however, to one species of *Acidalia*, for the vaguely named "Least Carpet," *A. rusticata*, F., is also supposed to flourish on a diet of withered leaves, though for rearing in captivity nearly the whole genus, apparently, may be fed up on knot-grass, *Polygonum aviculare*, dandelion, or other winter-green weeds. The larvæ hibernate naturally, but it is not unusual for some of the "forwards" in the breeding-cage to provide a late autumn emergence.

All the smaller Acidalias bear a strong family resemblance in colouring, with pellucid browns and delicate satiny ochres predominant. The larger species show more variety of design and hue, and of these *A. ornata*, the "LACE BORDER," is the most striking.

ACIDALIA ORNATA, Sc., has the wings soft satin white, with silver-grey borders, scalloped interiorly with darker brown; a discal spot of the same colour, and the fringes chequered alternate brown and white; the body, head, and thorax all of the same silvery white. The larvæ, which are best obtained by the use of a sweeping-net passed over the herbage where they occur, feed upon wild-thyme, but in captivity they have been reared on mint. They are, when full fed, rather less than an inch in length, brownish-ochreous on the back, the body freckled and mottled, with a pale ochreous stripe (Hellins). Essentially a Southern species, this pretty moth delights in chalk-banked hedges, and I used to take it years ago in that famous preserve of so many rare species, the Warren at Folkestone—the first brood in May-June, the second in August-September.

ACIDALIA IMITARIA, HAW., has been called the "SMALL BLOOD VEIN," and is at once distinguished from the other "Waves" by the rusty-reddish oblique stripes crossing all the four clay-brown wings transversely. The slender larva, which indulges the characteristic habit of standing straight out and rigid at right-angles to the stem of the food plant, is greyish-buff, lined with brown. It has a sufficiently catholic taste in the matter of food, and will accept chickweed as a winter diet, though Mr. South has bred it through with greater success on privet stems. It goes to earth in May, and the perfect insect, which is generally distributed, but does not occur in Scotland, is about in July and August.

In the little "RIBAND WAVE," *A. aversata*, L. (Plate XVIII., Fig. 1), we have an instance of dimorphic forms, both of them common—the one with the yellowish-grey wings adorned with a broad blackish median band; the other, and commoner (=ab. *spoliata*, Stgr.), without it.

Before passing on to the next genus, I may remark here that in the case of small delicate moths, or others, having thread-like antennæ, it is seldom possible to arrange them, when setting, in the method adopted with butterflies and insects having robust pectinated or simple antennæ. I have tried to get something like uniformity by inserting a small piece of paper under the head of the insect, covering the groove of the board, and then smoothing out the antennæ with a damp camel's-hair brush. I do not regard the results as particularly successful; but, at all events, antennæ set in this manner have not quite the shrivelled appearance of so many one sees in collections.

The genus *Zonosoma* contains six British species, of which four have been given by Haworth the name of "Mocha," by reason of a fancied resemblance in the colour and pattern

of the wings to a species of Arabian agate—transparent, with brownish markings. I have never seen this stone, so cannot say whether the comparison is well founded or not. There is the "False," the "Dingy," the "Birch," and *the* "Mocha"—local moths, of which the "Birch Mocha," *Z. pendularia*, Cl., has perhaps the widest distribution. Unlike the preceding genus, the Zonosomas hibernate as pupæ among the litter at the foot of trees, and the last mentioned species flies at the end of April, and, again, in a second generation, in August.

Sub-Fam. Œnochrominæ.

ODEZIA ATRATA, L. (Plate XVIII., Fig. 15), THE "CHIMNEY SWEEPER," in a sense merits its English name. The little moth has all four wings pitch black on both sides, with a faint suggestion of white at the apex, due to the fringes. In the days when small lads were employed by sweeps to climb chimney-stacks as best they might, *atrata* was known as the "Chimney Sweeper's Boy"; while in deference to the discovery that its food plant was not chervil, *Chærophyllum*, but the flowers of an umbelliferous plant, the earth-nut, *Bunium flexuosum*, it has now reverted to the original name conferred upon it by Linnæus. The larva is bluish-green, paler towards the red spiracles. The dorsal and lateral stripes are darker green—the former dark red toward the tail, with fine white lines also dividing the green. It pupates under ground, and the perfect insect makes its appearance in July, occurring locally, with a range as far north as the Caledonian Canal, throughout the United Kingdom. I used to take it many years ago, before the flowery railway-cuttings and embankments were annually devastated by fire, quite close to Harrow on the London and North-Western Railway.

[illegible]ENCE

Sub-Fam. Larentiinæ.

The first member of this sub-family, ***Sterrha sacraria*, L.**, can hardly be called a British insect. Abroad it has an immense range in southern Europe, the Canaries, Morocco, Asia Minor, and as far as India; here it is only the rarest, though a fairly constant, visitor; whilst the survival of so delicate an insect after so long a migration is difficult to understand. The fore wings are light canary-yellow, with an oblique stripe from the apex to the lower margin, the stripe varying in colour from brown, or crimson, to black; while in another form the canary-yellow is flushed with pink. I have seen it not uncommon on the hot hills that border the Mediterranean coast of France; and it is chiefly towards the sea, but not invariably, that the species has been taken in England.

ASTHENA CANDIDATA, SCHIFF.—The genus *Asthena* includes four fragile and small Geometrids, *candidata* being the smallest and plainest, with all four wings delicate satin-white lined with grey. The perfect insect flies in woods in June, and appears to be widely distributed, but local in the north, to Perthshire. The larva feeds on birch and hazel. It is when full fed yellow- to blue-green, with rich crimson dorsal intervals of colour, broken on the segments, and towards the tail forming a stripe; this crimson-blotched arrangement being characteristic of the other Asthenas, *A. sylvata* and *A. blomeri*. It presents a very "hunched appearance," and when about to pupate spins a slight cocoon to which it attaches itself by the tail to undergo the change. *A. blomeri*, Curtis, named (1832) after the discoverer of the species in England, near Durham, a Captain Blomer, is a larger, more handsome insect: the wavy lines yellow-brown; the female with a bright ochre

antemarginal band on the fore wings; and the ground colour creamy white. The larva, detected many years later at Bristol, feeds on wych-elm. Its range appears to be confined between the Thames and the Cheviots, occurring also sporadically in a few Welsh localities.

OPEROPTHERA BOREATA, HB., AND O. BRUMATA, L.—These are the "WINTER MOTHS": *brumata* (Plate XVII., Figs. 2 and 3) emerging in November, and flying as late as the end of January; while *boreata* precedes it by a month, and sometimes overlaps it in the more scattered localities where they both occur. *Boreata*, the larger and paler species, has not the same unenviable reputation as *brumata*, which, despite the "banding" and spraying of the trees, is a terrible pest in the orchard and fruit garden. The females, having but rudimentary wings, however, may generally be caught on the greased bands, whither also they attract vast numbers of males. But the more effective plan is to anoint the bark itself, as I find the females crawl up under the bands, taking advantage of the uneven surface of apple and pear trees. The slender larva may also be jarred out of the foliage in May, when it is light green, with a darker green dorsal marking, and spiracles of red upon a yellow lateral line. The green larva of *boreata* (a birch-feeder) is stumpy and thick by contrast; the black spiracles just above the yellow line, not on it.

ORTHOLITHA LIMITATA, SC., belongs to the group known familiarly as the "Mallows," and is one of the commonest of its kind in fields and on flowery banks where vegetation luxuriates in July and August. The fore wings are brown, with a darker median bar; the hind wings pale greyish-brown. "Beat nettles into a newspaper at the end of May and beginning of June," says Mr. Arkle, "you will obtain larvæ of the 'Plumes,' and a pea-green, very ungeometer-

like looking caterpillar with a humped back. This is the larva of *O. limitata*."

ORTHOLITHA BIPUNCTARIA, SCHIFF., is the "CHALK CARPET," a very common moth on the chalk and limestone hills of England and Wales, being, some four-and-thirty years ago, especially abundant in my own experience in the Warren at Folkestone, and, more recently, on the Chilterns. The larva is whitish-brown, stained with pink and dotted black; it feeds on trefoil, etc., from the autumn to the following June, the perfect insect flying in July and August. The fore wings are bluish-grey, banded with grey-brown, the discoidal spot replaced by two small black colon-shaped dots, the hind wings smoky grey.

Of the fifteen Palæarctic Lobophoras, five are found in Britain. They have all a more or less dentated brown band across the fore wings in the central area, and from this derive their name of the "Tooth-striped." *L. carpinata*, Bkh., flies during the last weeks of April, resting on the trees which are the food of its larva—honeysuckle, birch, alder, etc.—and it is, therefore, the "Early Tooth-stripe." At the same time, the eggs of *L. viretata*, Hb., the "Yellow-barred Brindle," are laid on shoots of holly, especially those bearing bloom; the green larva, with purplish and pink markings, consuming first the flowers, then the immature berries, and lastly the young leaves, and in captivity the leaves, and even stalks, of ivy.

TRIPHOSA DUBITATA, L., THE "TISSUE," bears a general resemblance to the "Scallops," *Eucosmia undulata*, L., and *Scotosia vetulata*, Schiff.—that is to say, the brownish-grey wings are traversed by darker scalloped lines, with deeply indentated fringes of brown and smoky grey. When first emerged, in August, fresh examples have a delicate rosy glow; but after hibernation in this phase the glory

fades. In April the moth is a not infrequent visitor at sallow. The larva feeds on buckthorn, spinning the leaves together in a sort of little tent; it is light green, striped with darker green, and occasionally develops yellow lines on the back and laterally.

LYGRIS PRUNATA, L.—Why Moses Harris, in the last quarter of the eighteenth century, should have named this little moth the "Phœnix" must remain a mystery; at all events, he was dissatisfied with his choice, and a few years after altered it to the "CLOUDED CARPET." Neither, however, can be considered satisfactory. The fore wings are faint yellow-brown clouded with darker brown; the central band, which in the female is broken in the middle, is deep chocolate, as also the blotch just below the apex; the hind wings pearly white-brown. It is a garden insect, the larva feeding nocturnally on black and red currant. Though local, it is generally distributed, the perfect insect flying in July and August.

Its first cousin, the "Chevron," *L. testata*, L., a much lighter brown and less strongly marked moth, may be distinguished by the chevron-shaped markings at the apex of the fore wings, being in contour exactly like the non-commissioned officers' chevrons worn on the glengarries of British regiments five-and-twenty years ago. It is a commoner insect than *L. prunata*, with which it is sometimes taken.

I now pass to the genus *Larentia*, which in Staudinger's "Catalogue of Palæarctic Lepidoptera" is made to include no less than 204 species—mostly of the moths familiarly known in Britain as "Carpets," from the fanciful and rather vague resemblance borne by them in the colours and patterns of the fore wings, though it may be objected that the manufacturer who succeeded in weaving a carpet

at all faithfully reproducing the tints, or the light and shade of a moth's wing, would achieve a fortune.

THERA JUNIPERATA, L., THE "JUNIPER CARPET" (Plate XVII., Fig. 4), may be instanced as typical of the delicate patterning of the genus. We have two forms: a rather larger and less strongly marked—the English; and a smaller—the Scotch: for, as a rule, where the juniper grows in abundance the moth is present—in the south-eastern counties, and more commonly right through Scotland to the Shetlands. The ground colour of the fore wings is pearly grey-brown, with a strong, broken median band, narrowing to the inner margin, and two brown dashes coming towards it from the apex; the larva, when full fed (Fig. 4*a*), is a delicate whitish-green, with the spiracular stripe of yellowish-white tinged pinkish. The moth is on the wing in October and November, and may be found after dark resting on the juniper bushes.

CIDARIA MIATA, L., THE "AUTUMN GREEN," is another very beautiful member of the "Carpet" family: the fore wings mottled deep green, and, in the female, with darker central bands; the hind wings greenish-white, with a black discal spot and a thin marginal green line. In the "Red-green Carpet," *C. siterata*, Hufn., the green colouring is more concentrated, and there is a rosy glow on the wings. The larva of *miata* is very slender; pale green tinged with yellow, with a ventral pinkish-brown stripe. It may be beaten from sallow, birch, etc., in June; and the moth, while occasionally attracted to light, is always in evidence after dark on the flowering ivy clusters.

CIDARIA TRUNCATA, HUFN., belongs to the brown "Carpets," and, as is usual in this group, shows a somewhat bewildering tendency to vary, so that I can only very roughly describe in words their appearance. Known as the "COMMON MARBLED CARPET," the suggestion of marbling

might be applied to them all, though the hind wings are almost invariably greyish to white. In all there is a well-developed marginal band, with the central and basal area of the wings broken up, as a rule, with lighter transverse markings. The larvæ, also, in shape and colour closely resemble one another; and they feed not only on the foliage of many trees, but on wild-strawberry, bilberry, etc. Of *C. truncata* there are two emergences—the first in May and June; the second in September, and sometimes, in mild seasons, on to December.

AMŒBE OLIVATA, BKH., AND A. VIRIDARIA, F.—The first of these, the "BEECH-GREEN CARPET," is the smaller of the two, and has the fore wings mottled greenish-grey, with a dark median blackish band. It is a beech-wood insect in the western counties, and locally in the Chilterns; and in Scotland, where it becomes more abundant. *Viridaria*, the "GREEN CARPET," is much the commoner and more widely distributed. It is larger; the fore wings a more lively olivaceous green; the median band with two dark brown blotches at the costal margin, and one where it narrows to the inner margin. I have often found it in our few remaining Middlesex woods in July, and sometimes there is a second emergence in September. The olive-brown larva feeds on bedstraw.

XANTHORHOË FLUCTUATA, L. (Plate XVIII., Fig. 5).—The next group includes some of the very commonest of the "Carpets"; and *fluctuata*, the "GARDEN CARPET," is no exception to the rule, while it varies to an astonishing degree in the arrangement of markings and tints of the fore wings. In the most usual form they are mottled brownish on greyish-white, the dark median band broken, or terminated, half-way across, and markings of the same shade at the bases. The larva, as is so generally the case with garden

insects, is polyphagous on low herbs, cabbages, etc.; it is any colour from grey to dirty green, with pale dorsal blotches. Quite as variable is *X. montanata*, Schiff., the finest form being that in which the ground colour is shining white, and only the median band of the fore wings is present—dark brown with a black discal spot. It is a bedstraw feeder, and on the wing may be mistaken for *Anticlea cuculata*, Hufn., a much rarer "Carpet," which also affects this plant, as do so many of the "Carpet" tribe.

XANTHORHOE SOCIATA, BKH., belongs to the "Carpets" with the ground colour of the wings generally white; the markings varying from purplish-black to warm brown; the median bands strongly pronounced, with a distinct discal spot enclosed. The larva varies as much in colour as that of *fluctuata*, and also patronises bedstraw. The moth flies in midsummer, and again in September, being distributed from one end of the United Kingdom to the other.

XANTHORHOË TRISTATA, L., AND EULYPE HASTATA, L.—These are the "ARGENT AND SABLE MOTHS," Small and Large, and Moses Harris was more than usually happy in giving them the heraldic name, for it exactly describes the colouring and pattern of the wings of both species—*tristata*, however, showing a great colour variation from black to brown, *hastata* more in the direction of the intensity of the wing markings. *Tristata* is the rarer of the two, confined to Wales and the western counties in June, but over the Border more common. *Hastata* is taken in the south and in the east in May and June. But whereas the former is again a bedstraw feeder, the latter lives on birch, *Vaccinium*, and sweet-gale, spinning together the leaves so as to form them into a little chamber, the walls of which it proceeds to consume. *Hastata* is a day-flier, slow on the wing over the wettest parts of the Westmoreland mosses; while *tristata* has

a fondness for resting on the grey Derbyshire stone walls that take the place of hedges in the North.

PERISOMA AFFINITATA, STEPHENS.—The next group of Geometers is that commonly known as the "Rivulets," in compliment, I suppose, to the meandering median bands which traverse the fore wings of most of the species. They are small insects, with variegated brown-barred fore wings, the hind wings usually plain, with a suffused marginal border. The larvæ are characteristic in their habits, feeding, as a rule, on the seeds of plants, or, in default, the immature buds. In *affinitata*, the "RIVULET," a not uncommon moth throughout the country, the fore wings are warm brown, with an irregular whitish band. The larva, which is disproportionately small to the perfect insect (also a not uncommon trait of the genus), lives in the seeds of the red campion, *Lychnis dioica;* it is light drab, tinged and lined with pink, and it pupates on the surface of the ground. The imago flies in June.

PERISOMA FLAVOFASCIATA, THNB., THE "SANDY CARPET," is a rather larger insect—the fore wings lightly marked with faint yellow ochre, the fringes chequered the same colour and white. The larva feeds on the flowers of the campion, and later within the seed capsules, like that of *affinitata*; it is putty-coloured, with purplish-brown stripes and markings. Unfortunately the name by which it has been known in England so long—*decolorata*, Hb.—has been found to be pre-dated by *flavofasciata*. In the interim some one has named a recently-discovered high alpine "Ringlet" butterfly *flavofasciata*; and, properly speaking, the butterfly ought to be re-christened scientifically—a good instance of the confusion caused by naturalists giving names without first searching the list for those already adopted.

CAMPTOGRAMMA BILINEATA, L., is perhaps the commonest summer Geometer, and there are few of us, whether entomologists or not, who have not noticed at dusk the hedgerows alive with the mottled ochreous-winged "YELLOW SHELL." The larva is a grass and chickweed feeder; it has two forms —(i.) pale green, with dorsal dark and pale green stripes, and below them a flesh-coloured stripe; (ii.) drab, with alternate lighter and darker stripes. It is not uncommon to see hundreds of them on the fresh-mown hay—an agreeable feast for the attendant birds. They hibernate in this phase, pupating in April and May.

HYDRIOMENA FURCATA, THNB.—The "Yellow Shell" varies not a little in the depth of the markings of the wings; but it is nothing in this respect as compared with the "JULY HIGHFLYER" and the "May Highflyer," *H. impluviata*. The type form of *furcata* has the fore wings ochre-grey, with a pale blotch near the base, and dark-banded; while in *impluviata* there is a decided greenish tinge present. In some examples, however, the bands are absent (=ab. *obliterata*, Prout); in others the general tint is red-brown (=ab. *fusco-undulata*, Donovan), more rarely inclining to black (=*infuscata*, Stgr.). Indeed, *furcata* furnishes the student with ample material for the study of variation, for it is as perplexing in its infinite variety as it is common. The larva is usual on sallow, poplar, hazel, etc.; but it has been found (a small form) on bilberry, with a correspondingly smaller, shabbier-looking race of moths. When full fed it is brown, with white lines along the back and sides, tinged red on the spiracular region (South).

ANTICLEA BADIATA, HB.—With the first warm nights in April, and even March, this pretty moth is tempted to the golden sallow catkins, or to the lamp; while in the day-time it may be disturbed from the hedges, where it lays its eggs

on the wild-rose. The fore wings are generally deep umber-brown on a paler ground; the "SHOULDER STRIPE," from which it takes its English name, represented by dark brown at the bases; towards the outer margin paler reddish; the hind wings are plain, smoky white-brown, with suffused marginal border. The larva is apt to vary in appearance, but may be described as yellowish-green, with (sometimes) a brown-purple spiracular stripe; it descends into the earth to pupate, constructing a compact small cocoon.

ANTICLEA NIGROFASCIARIA, GOEZE.—In the "STREAMER" the "shoulder" or basal stripe is usually a decided purple-brown, and the fore wings are further embellished with a purple blotch near the apex, which is also heavily marked with the same colour. It flies at dusk a little later than *badiata*, and I have often seen it asleep in the day-time on palings—a rather conspicuous object. The larva is also a wild-rose feeder, and is green with a purple-brown stripe on the back. Both species hibernate in the pupal phase, and both are common as far north as Inverness.

The "Barberry Carpet," *A. berberata*, Schiff., and the "Royal Mantle," *A. cucullata*, Bkh., are much more localised—the former in the eastern counties, the latter on chalk to about as far north as Oxfordshire.

I much regret that considerations of space make it impossible for me more than to allude to the Eupithecias, or "Pugs." As a race they are the smallest of Geometers; the larvæ feeding for the most part on the flowers and seeds of plants, from which they may be beaten into an inverted umbrella; the perfect insects seldom exceeding three quarters of an inch in the expanse of the wings, but presenting in miniature a wide variation of colour and markings. The figure of the "Green Pug," *Chloroclystis rectangulata*, L. (Plate XVIII., Fig. 3), a common, variable species,

gives a good idea of the general appearance of the genus.

Sub-Fam. Boarmiinæ.

ABRAXAS GROSSULARIATA, L. (Plate XVII., Fig. 5), is the familiar "MAGPIE" moth of our summer gardens. In the typical form the wings are black spotted on a white ground, with orange-yellow central and basal bands on the fore wings; the body brilliant orange, with a dorsal line of black dots. The larva, which is very destructive upon gooseberry bushes, anticipates the colours of the perfect insect, hibernating normally in this phase. The moth appears in early summer, and, common though it be, the extraordinary tendency of the species to vary has made it a great favourite with amateurs, who often give and receive large sums of money in the sale-rooms for their bred "Magpies."

DILINIA PUSARIA, L., THE "COMMON WHITE WAVE," and the "Common Wave," *D. exanthemata*, Sc., are both abundant in our summer hedgerows: the former with all the wings white, traver[illegible] by grey lines; the latter much the same in appearan[illegible] out the lines ochreous and somewhat suffused. Doub[illegible] brooded, the moths are on the wing in May, and again from July to September.

METROCAMPA MARGARITATA, L.—This pretty moth has been christened the "LIGHT EMERALD" by reason of its pale green colour, all the wings being traversed with a whitish line, edged interiorly with olive-green. The larvæ feed on various forest trees and hibernate; they are inclined to vary in colour from light yellowish-green to drab, or purplish-grey freckled darker, with a pale grey series of dorsal markings. The perfect insect may be disturbed from the undergrowth in woods throughout the United Kingdom in June and July.

The next group of insects is known as the "Thorns";

they are mostly of considerable size, and ochreous winged, with strongly pectinated antennæ.

ENNOMOS ALNIARIA, L. (Plate XVII., Fig. 6), THE "CANARY-SHOULDERED THORN," may be taken as typical of the group, being at once distinguishable by the tuft of canary-coloured hair on the thorax. The fore wings are yellow, traversed by two curved brown lines. The larva, like that of all its kind, imitates closely a twig of the birch or sallow on which it feeds—a long brown stick-like creature—the darker dorsal markings and humps, with the curious toad-like excrescences, making it extraordinarily difficult to separate from its surroundings. The eggs are laid in the autumn, hatching in May, and the perfect insect is generally distributed.

While the largest of the "Thorns" is the very rare *E. quercinaria*, Hufn., decidedly the most beautiful is the "Lilac Beauty," *Hygrochroa syringaria*, L., a double-brooded species of early spring and summer, in which the ochreous tint is suffused with purplish-brown. The "Lunar Thorn," *Selenia lunaria*, Schiff., with the white half-moon discal spots on all four wings, has only the marginal areas reddish-brown, the apical blotch and whole central and basal area deep brown to purple. The larva, again, is astonishingly like a gnarled and twisted twig of sloe or birch; it may be taken by "beating" by day or night.

ANGERONA PRUNARIA, L., THE "ORANGE MOTH," derives its name from the brilliant chrome wings of the male, the female being decidedly more sober in her garb—drab ochreous, with ochreous central band. But so variable is this species, that almost any variation upon the typical colouring may be looked for. In normal seasons the larvæ, which also vary to the colour of the stems of sloe or birch, feed up in the autumn, hibernate, and pupate in May, the

moth appearing in June. It is a Southern species, rarely found north of Yorkshire.

URAPTERYX SAMBUCARIA, L. (Plate XVIII., Fig. 2), THE "COMMON SWALLOW-TAILED MOTH," flies in July, and may be seen on warm evenings at dusk zigzagging rapidly over hedges. It is uniform primrose-yellow, the wings traversed by darker lines, and the hind wings and apex of the fore wings sharply angled. The larva is another successful imitator of the stem upon which it rests, and experiments upon it in captivity prove also that it is most adaptable to the colour of its surroundings. It feeds on various trees, but seems to prefer ivy, hibernating in the thick of it until May, when it pupates. I have sometimes found it very common at light, and it occurs in most suitable localities as far north as the Firth of Forth.

OPISTHOGRAPTIS LUTEOLATA, L. (Plate XVIII., Fig. 6), THE "BRIMSTONE MOTH," is another very common and unmistakable species—all the wings bright sulphur-yellow, with a red-brown ocellated discal spot, and a blotch of the same colour at the apex of the fore wings. The larva, again, is very stick-like, and feeds on sloe and plum, the offspring of the second brood of the moth hibernating in this phase. It occurs all through the spring and summer, from April to September.

VENILIA MACULARIA, L. (Plate XVII., Fig. 7).—Among the blue hyacinths in May there is no more gay little moth than the "SPECKLED YELLOW"—the whole of the ground colour of the wings brilliant yellow, blotched with purplish-black. The larva is grass-green, with a thin dorsal line of black, and lateral stripes of various shades of green and white—in fact, very much the colour of the leaves of the wood sage, upon which it lives, though by no means exclusively, as it will eat red dead-nettle and woundwort.

It seems to be widely distributed even as far north as Sutherlandshire.

Our next group contains the earliest, and some of the latest, moths on the wing during the year; and they have this peculiarity also, that the females are wingless, or rather are provided only with rudimentary wings useless for flight, so that they must be sought with a lantern by night sitting on the twigs of their respective food plants.

HYBERNIA RUPICAPRARIA, HB., THE "EARLY MOTH," is already about in the dusk of January evenings, seeking the females at rest in the hedgerows. It is an inconspicuous insect: the fore wings greyish with a faint brown tinge, and the discal spot well marked; the hind wings pearly grey. The larvæ is very common on various species of thorn, being full fed at the end of May; the pupal phase thus lasting the six summer and autumn months. It is usually green, the segments divided and dotted with black.

HYBERNIA LEUCOPHEARIA, SCHIFF., THE "SPRING USHER," follows very closely upon the preceding moth in February, and may often be seen during the day at rest on fences. It is also extremely variable in appearance, the fore wings most frequently marked brown and white, but in some examples losing the white marking altogether. The larva may be beaten from oak in the spring, when it is much the same colour as the young leaves. The moth has a wide range to the Moray Firth.

HYBERNIA DEFOLIARIA, L.—At the other end of the Hyberniid calendar comes *H. defoliaria* in October and onwards, varying wonderfully in the colour and marking of the wings from almost plain reddish-yellow to white barred with purple-brown, and the discal spots prominent. When covert shooting in November I have seen these in hundreds, and it is owing to the depredations of the

larvæ in the spring that sometimes we see whole coppices denuded of their foliage. They are rather handsome, the dorsal colour varying from purplish to bright umber-brown, then a black lateral stripe, and beneath it the body bright yellow, often with a red spot on each segment. South of the Cheviots it is only too abundant.

LYCIA HIRTARIA, CL. (Plate XVII., Fig. 8).—There seems to be some connection between the winglessness of the females and the season of the year when the moths emerge. The females of the "Small Brindled Beauty," *Apocheima hispidaria*, and of the common February "Pale Brindled Beauty," *Phigalia pedaria*, are wholly incapable of flight, but that of the "BRINDLED BEAUTY," *L. hirtaria*, a March and April moth, is normal—the wings reddish-brown, with lighter antemarginal bands, and the whole surface having a peppered appearance. The larva, which has a special fondness for pear trees, is another of the "stick" fraternity—light brown, with some yellow spots, but occasionally dark greenish-brown.

AMPHIDASIS BETULARIA, L., THE "PEPPERED MOTH," is at once to be recognised by the white black-peppered wings, while it is a curious example of an insect which, in Britain at all events, is evolving rapidly a new pattern, the wholly black ab. *doubledayaria*, a good instance also of a cumbrous name to the memory of one of our greatest lepidopterists of the earlier generation—Henry Doubleday, of Epping. We find, indeed, that already in many parts of the country the black form is predominant. The stick-like larva varies considerably with its environment; seen looking down upon it, it rather suggests a fungus-affected twig—grey, with white warty protuberances, and grey-green bands dividing the segments. The moth appears in most places in May or June, and I have dug

the black pupa not infrequently at the roots of our Middlesex oaks.

BOARMIA REPANDATA, L., THE "MOTTLED BEAUTY," a very common moth, may be taken as representative of the Boarmias. It is a rather large Geometrid, with indeterminate mottled wings, varying to every conceivable form and design with the localities in which it is found; but the reddish-brown larva is altogether less elaborate than those of the preceding species I have described, though occasionally marked on the back with what look rather like the hieroglyphics on an Egyptian tomb. The perfect insect flies in May and June, and is generally distributed.

GNOPHOS OBSCURARIA, HB.—Passing the Tephrosias, the next species figured is the "ANNULET" (Plate XVII., Fig. 9), another of those speckled middle-sized Geometrids which appear to present a different form in every locality where they occur, the typical grey German form being perhaps the rarest with us. The larva, which is stone-coloured, and has a rather wrinkled appearance, may be found in the winter by searching at night plants of *Geranium lucidum*; it will also feed on strawberry and rock-rose. The perfect insect is on the wing in July and August.

EMATURGA ATOMARIA, L. (Plate XVII., Fig. 10), THE "COMMON HEATH," may be accepted as representative of medium-sized Geometers, affecting for the most part heaths and moors, including the "Black Mountain Moth," *Psodos coracina*, of the Highlands, which is a veritable alpine, flying by day whenever the sun is out, and with its "all black" wings resembling a small edition of the larger *Dasydia tenebraria*, Esp., of the loftiest Alps, which accompanies the great "Ringlet" butterflies to the eternal snows. *Atomaria*, however, is common in Britain to the Orkneys, and a very variable species at low levels—the fore wings netted white

and dark brown, but in many cases the brown suffusing most of the ground colour. The larva, too, is almost as variable in marking and colour as the moth; it feeds on ling, heath, and broom, the perfect insect appearing in May and June, and also less abundantly in August.

B. II. SUPER-FAM. DREPANULIDES.

Fam. Drepanidæ.

This family contains the peculiar "Hook-tipped" moths, of which it is also remarkable that they have no proboscis, while their larvæ are minus the anal claspers. Six species exist in Britain—one of them, the "Scarce Hook-tip," *Drepana harpagula*, Esp., in a single locality near Bristol, where it has survived the inroads of generations of collectors for eighty years. The others are fairly abundant where they occur—generally in the woods of the south of England.

Drepana falcataria, L. (Plate XXI., Fig. 6), the "Pebble Hook-tip."—The fore wings vary from dead-leaf brown to light ochreous. In some examples the large discal blotch is almost effaced by the zigzag central lines, while from the apical "hook" downwards there is either a suffused or a distinct line of brown. The hind wings are waved, with a scalloped brown marginal border, and the antennæ of the male are rather strongly pectinated. The larva is spinous on the back, which is coloured umber-brown, with small white spots, the whole ventral and spiracular area grass-green. It is a birch and alder feeder, pupating between two leaves spun together; and the perfect insect haunts birch groves in the spring. The larva of its congener, *D. binaria*, Hufn., in its final moult rather apes the much larger "Puss Moth" in shape, but is claret-coloured, instead of green, with a white "saddle"-fringe. Common in oak

woods of the South, it is inclined to cannibalism in confinement, and should have plenty of space and a good supply of food plant to prevent accidents.

CILIX GLAUCATA, Sc. (Plate XXI., FIG. 7).—This small, white, silvery-satin moth has been called the "CHINESE CHARACTER" for some reason which is not apparent on the face, or rather, I should say, the wing of it. Only by an extreme effort of the imagination are the black over-markings of the ochreous blotches to be regarded as representing any of the cabalistic signs of the Celestial alphabet. The larva is red-brown, with a darker dorsal line; it pupates in a tough cocoon among leaves or under bark, and the perfect insect flies twice in the year—in May and June, and again in July and early August, when it is generally common. I have taken many examples in a single June evening at light in Middlesex. At rest in the day-time it curiously resembles the dropping of a bird. The Firth of Forth is its northern limit.

B. III. SUPER-FAM. CYMATOPHORIDES.

FAM. CYMATOPHORIDÆ.

Of the nine British Cymatophorids several are of striking beauty.

HABROSYNE DERASA, L., is called the "BUFF ARCHES," I presume, from the colour scheme of the fore wings—bright brown over the whole central area, triangled with a broadish white line, and the base of the triangle, which is the costa, blotched, or rather frosted, with white. Among the withered leaves, where it sleeps by day, it is almost invisible; bramble, a favourite hiding-place, being also the food of the larva, which is rust-coloured, with a blackish dorsal line and yellowish side-spots. The pupa is contained in a cocoon beneath the earth, and the moth is an eager visitor among

the horde of common things which flock to the sugar patches on warm nights in late June and July. It is confined in Britain to the zones south of the Clyde, and occurs also in Ireland.

THYATIRA BATIS, L., THE "PEACH-BLOSSOM," amply merits the popular name accorded it, for the two large apical, the outer marginal, and basal spots of the fore wings are all of an exquisite pink, recalling the blossom of peach trees, and, set as they are in an olive-brown ground, the effect is charming. Nor is the moth particularly rare; indeed, in the early nineties, in woods not fifteen miles north-west of the Marble Arch, I used to find it in some abundance. The eggs are laid on bramble; the night-feeding larva when full fed is the brown of a changing leaf, shaded darker, with brown lines on the back and sides, the arrangement of the segments rather suggesting small armour plates superimposed one behind the other down the body. There are two emergences—"forwards" of the spring-laying appearing in August or September, while June is the normal month for the original parents. It occurs throughout the three Kingdoms in suitable localities, and pays but flying visits to sugared trees, so that it is best captured in the net.

POLYPLOCA RIDENS, F. — The best way to procure examples of this pretty moth, which should be out in May or late April, is undoubtedly by "beating" the larva, or by digging the pupa at the roots of oak, for neither light nor sugar appears to exercise a fascination upon it. The fore wings display the "FROSTED GREEN" which gives it its popular name; the ground colour varies from whitish to darker green, crossed by lines and chequers of whitish-grey. The larva is yellowish above, with a green-grey dorsal stripe and a yellow spiracular line, and it is not uncommon in this phase in many of our southern counties' oak woods.

Description of Genera and Species

B. IV. SUPER-FAM. BREPHIDES.

Fam. Brephidæ.

The two " Orange Underwings " have given scientists no little difficulty in assigning them to a proper place in the system of classification. In one or other of their phases they develop characters which seem to separate them alike from the Noctuid and the Geometrid families. For instance, the larva of *Brephos notha*, Hb., the " Light Orange Underwing," lives between two spun-together leaves of aspen, contrary to the habits of the Noctuid larva ; while eventually it bores into the soft wood and pupates in a chamber within the stem—an abnormal proceeding for a Geometrid.

Brephos parthenias, L. (Plate XVI., Fig. 8), the " Orange Underwing," is the commoner and most widely distributed of the two species, and is distinguished by the beautiful orange of the hind wings ; the fore wings mottled purplish-brown, with a light ochre blotch at the centre near the costa, and another smaller one near the apex. The larva, which feeds on the birch, first the catkin and then the leaf, is just the colour of the catkin—green, with fine white dorsal and lateral stripes. The perfect insect flies about the last week in March, frequenting sunny birch woods, as a rule in the afternoon ; it also loves to bask, butterfly fashion, on the warm patches of sand in the grassy drives of some forests. The females will lay freely in confinement ; and the moth is generally distributed as far north as Durham, and then from the Tay to the Moray Firth. Apparently in Ireland it has only been observed in the east.

B. V. SUPER-FAM. PYRALIDES.

Fam. Pyralidæ.

In this family are included a number of sub-families made up of genera containing small, delicate-winged moths, as a rule sober in their appearance, but attractive none the less to the student as presenting in their preliminary phases many remarkable developments of structure and life habit. The larvæ as a whole are smooth, rather colourless, and extremely active, and they pupate in cocoons; but as the earlier writers on butterflies and moths stopped short with the Noctuids or Geometrids as their fancy dictated, the Pyralids have been undeservedly neglected alike by collectors and observers. A certain number, as we have seen—the "Snouts" and the "Fanfoots," for example—have been transferred bodily to the Noctuids. I shall mention a few of the commoner, but none the less interesting, species still grouped under the family name.

Sub-Fam. Galleriinæ.

This sub-family contains the very extraordinary race of moths which make their home in the hives and nests of bees and wasps, but the larvæ are rarely found in the underground habitations of these insects. That of *Aphomia sociella*, L.—I am afraid I must not attempt English names for the group owing to the above-mentioned indifference of the British godfathers of moths to the small fry—maintains itself on the papery substance of which the wasp's nest is constructed, tunnelling it into galleries, and pupating therein. The perfect insect flies in July and August, and is distinguished by the faint olive grey-green of the fore wings, with a pinkish median band and a distinct black discal spot. The destruction done to bee-hives by the members of this group is often

enormous; but it will be noted that the larvæ do not eat the honey, but merely the wax, and the dry material of which the nests are sometimes constructed.

Sub-Fam. Crambiinæ.

About thirty species of this sub-family inhabit the United Kingdom. They are to be recognised by the curious umbrella method observed by them in folding their wings when they come to rest after short flights in the grass, upon various kinds of which their larvæ for the most part feed. The several species bear a general resemblance to each other: the fore wings light ochreous brown, with more or less broad streaks, widening from the base towards the outer margin.

Passing several sub-families, some of which are hardly represented in Britain, we come to the

Sub-Fam. Phycitinæ.

EPHESTIA KUEHNIELLA, Z.—This little Pyralid is an unwelcome recent addition to the British List, being first detected in Germany about thirty-five years ago, and ten years later in England, where it continues to thrive and multiply, sometimes doing great injury in rice and flour mills, and maintaining a series of broods throughout the year. The larva is slightly hairy and dirty white to pinkish, committing its depredations from little silky tunnels constructed among the flour. The fore wings of the perfect insect are greyish-white, with a general appearance of having been dusted over miller-fashion. The hind wings are lustrous white, with brown outer margin. Other *Ephestia* larvæ tackle figs and dried fruits, while not averse in some cases to consuming the bodies of neglected lepidoptera in store-boxes—a rather arid taste which they share in common with those pests of the collector, the mites.

Sub-Fam. Pyralinæ.

AGLOSSA PINGUINALIS, L. (Plate XVIII., Fig. 8).—This little moth apparently owes its name to the singular belief that it fed on greasy things—lard, butter, etc.—the larva being provided with a special apparatus to prevent suffocation by the spiracles being closed. This yarn sufficed for a century, when the fable was discredited, and diet of the very opposite nature found to be that on which the creature flourished, viz., the dry husks, seeds, and rubbish collected in barns, stable-mangers, etc., where the larva constructs its tubes, always choosing, apparently, a cool dark spot. In these tubes it hibernates; the full-fed larva plump in outline, and black or blackish-brown, " sometimes a little bronzy " (Buckler). The perfect insect is common on the walls of sheds, stables, etc., in July. It is a rather large Pyralid; the light brown fore wings marked with darker spots, the hind wings smoky grey, with a paler antemarginal band. It occurs throughout Ireland, and in Britain as far north as Perth.

PYRALIS FARINALIS, L. (Plate XVIII., Fig. 11).—As its name implies, *farinalis* haunts the flour mill, and is often as common as the preceding species from June to August, taking two years from the hatching of the egg to complete its several phases. The larva also constructs tubes spun together from flour dust, and when full fed is " bone-white, delicately shagreened," the head shining chestnut-brown. It spins a tough white silk cocoon, coated with flour-waste and rubbish to pupate. The perfect insect is decidedly handsome—the fore wings black-brown at the bases, with an outer white margin; the central band ochreous, and divided also from the marginal ?-shaped blackish band by another white border; the hind wings with a central band of the same blackish shade, white edged, and near the

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lower angle with black spots. It occurs as far north as the Caledonian Canal.

Sub-Fam. Hydrocampinæ.

As the name of this sub-family suggests, the several genera included have a close connection with the water.

NYMPHULA NYMPILÆATA, L., may be taken as an interesting example of amphibious habit; and no more minute life history of the species is to be found than that written by the great naturalist Réaumur two centuries ago. The eggs are laid on pond weed, *Potamogeton;* and the larva, after a few days' mining in the leaves, constructs a little floating case by spinning together leaves of the several aquatic plants it consumes. Under water, but occasionally just above the surface, on any convenient plant, it constructs another unattached habitation when hibernation is complete, and it seems that both larva and pupa thus provide themselves with something in the nature of a diving-bell, inasmuch as they are able to breathe without apparent inconvenience. The case is then attached for pupation edgewise to a floating leaf or submerged stem, and the perfect insect flies—continuously, I think—from the end of June to the end of August. The dainty pattern of the wings—soft brown on white, and in the female effectively marked out with darker lines—has earned for *nymphæata* the unusually appropriate name of the "CHINA MARK." It is common within the same limits as the preceding species.

NYMPHULA STAGNATA, DON. (Plate XVIII., Fig. 7), is another of the "China Marks," and frequents the neighbourhood of ponds from June to August. The moth is rather smaller than *nymphæata*, and the wings show much more white in proportion to the ochreous markings. The larva is entirely sub-aqueous, mining the submerged

stems of reeds, and in its later stages, after hibernation, uniting the leaves together and feeding upon them. In colour it is transparent yellowish-brown, with what appears to be a dark dorsal line. The pouch-like receptacle in which it pupates is also made of reed fragments, and anchored with silk to a floating leaf. The perfect insect is distributed very generally over Ireland, and Britain as far north as the Clyde.

EURRHYPARA URTICATA, L. (Plate XVIII., Fig. 4).—Although grouped in the same sub-family as *nymphæata*, this Pyralid, except that the larva feeds not uncommonly on the nettles which grow in ditches, has no claim to be called amphibian. It rolls up the leaf of the food plant very much after the manner of a Tortrix larva; hibernates in its hammock-shaped cocoon, which is further protected by an outer web of silk; and eventually pupates in April. When full fed it is much the same colour as the nettle leaf, with a thin dark green dorsal line and a few single short hairs. The perfect insect emerges about midsummer, and is a familiar object flitting about the hedgerows at dusk. The wings are dead white, with black on the border, and broken antemarginal bands of black; the thorax yellow; and the body striped alternately black and yellow. It does not appear to fly north of York, but is reported from various Irish localities.

B. VI. SUPER-FAM. TINEIDES.

Notwithstanding a recent re-classification, which has removed a certain number of this super-family into others of our series, the "Tineids" still contain more species than any other division of British moths. Their small size and the difficulty of locating so many of their larvæ afford a wide scope for investigation for those who, having mastered the

easier fields of the Macro-, are not to be daunted by the superficially less attractive Micro-lepidoptera. Their name associates them with the destruction of clothes; and probably the best known of the Tineids, and the most difficult to contend against, are the all too familiar "Clothes Moths," whose larvæ consume and destroy annually an immense amount of valuable material in one form or another. The three worst offenders in this respect are *Tineola biselliella*, Hummel, *Tinea pellionella*, L. (Plate XVIII., Fig. 12), and *Trichophaga tapetiella*, Z.; and when any of them have effected an entrance into the wardrobe or chest-of-drawers, the difficulty is to get rid of them. All sorts of insect powders are on the market for the purpose, I am aware. But the mortifying fact remains that the Tineid larvæ generally come off the conquerors where sprinkling only is employed, and the sole effective way of making destruction certain is by baking the infected garments bodily in the oven; for the naphthaline, which we find a *preventive* of mites in our cabinets, is only a *preventive* against moths—it will ward off, but will not exterminate the enemy. Nor are cloth clothes the only objects of Tineid attack. They thrive on all sorts of unlikely stuff—the hair of living animals, the horns of antelopes, even the hoofs of horses. Others, again, are destructive to dry potatoes; and the singularly unpromising diet of wine-bottle corks, coupled with a taste for cellar mould, distinguishes the larva of *Oinophila v-flavum*, Haw.—therefore rather inaptly named the "wine-lover." I could add many other species to the Tineid "black list," but the few enumerated are sufficient to illustrate the diverse and dry pabulum on which so many of these moths are reared.

Entirely different in their ways are the Coleophorid or Sheath-bearing Tineids. In the early larval stages they are leaf miners, but later construct for themselves little

sheath-cases in which they move about on the food plant and feed. The larva of *Goniodoma limoniella*, Stt., a pretty little moth with golden-tipped ochreous fore wings and grey hind wings, affects the flowers of sea-lavender, *Statice limonium*. "Eating out one of the petals," says Elisha, "it uses it as a case until full fed, when it crawls down the stem, eats its way inside, and covers up the entry with a slight web, soon after which the case drops off." The larvæ of *C. juncicolella*, Stt., browse on the young shoots of heath in cases closely resembling the smaller leaves of the plant. Some cases, again, are comparatively large and conspicuous—as the cylindrical construction of *C. ochrea*, Haw., more than half an inch in length, on the leaves of the rock-rose.

Among the *Gelechiidæ*, the larvæ of the coast-haunting *Lita marmorea* build for themselves little tubes of sand and silk under plants of *Stellaria triviale*; while another of this Tineid group, *Aristotelia arundinetella*, Stt., may be found on sedge, but the cocoon, which is placed but a short distance above the water, so closely approaches the withered leaf in appearance as to be almost invisible.

Yet another group of Tineids is composed of leaf-rollers and miners combined: *Gracillaria syringella*, F., for example—a moth with yellowish-brown fore wings, mottled with dark brown, and near the apex an ocellated mark with black centre. The young larva at first eats into the soft substance of the lilac leaf; later it emerges, and, spinning the edges together, twists the leaf into a conical-shaped habitation.

Thus it will be seen that the Tineid larvæ are as diverse as interesting in their habits, and will repay by their great variety a closer study than is usually given this large subfamily by the entomologist.

There is yet another family of Tineids, which has attracted far more attention at the hands of collectors, because until quite recently their inclusion in the group was not an accomplished fact. In most British cabinets the "Clearwings" are ranked close to the "Burnets"; and, I daresay, had the earlier authors of works on Macro-lepidoptera realised that they belonged to the neglected "Micros," very much less would have been written, and very much less known, about the life histories of these exceedingly interesting and beautiful insects.

Fam. Ægeriidæ.

The "Clearwings," as they are well called, are diaphanous-winged day-flying moths, loving sunshine, and owing, no doubt, to the singular resemblance many of them bear superficially to insects of other Orders, accounted something of rarities as a whole. The exceptions are *Trochilium tipuliforme*, Cl., the "Currant Clearwing," the larvæ of which work havoc on the stems of currant bushes; and *T. myopæforme*, Bkh., the "Red-belted Clearwing," which still, I believe, haunts Regent's Park. The majority of examples in collections, however, have been obtained by breeding — cutting infected stems and planting them in moist sand.

Ægeria apiformis, Cl. (Plate XV., Fig. 6), is known as the "Hornet Clearwing" from its general appearance: the head and shoulders yellow; thorax black; body black and yellow-barred; wings transparent, with yellowish-brown costa and margins; the nervures clearly displayed. The larva bores into the roots and trunk of the black poplar near the surface, but when full fed returns to the outside, spins a cocoon, in which it hibernates, finally pupating therein in May; and the perfect insect, which may sometimes be found

drying its wings before noon on the tree-trunk, emerges in June and July.

TROCHILIUM SPHECIFORME, GERN. (Plate XV., Fig. 4), THE "WHITE-BARRED CLEARWING," may be cited as typical of the middle-sized members of the family. The transparent fore wings are margined, broadly at the apex, with black-brown, the discal spot large and distinct, while the black body has a single white bar across it, and the tail is black. The larva lives in the fresh shoots springing from alders which have been cut back, and is sometimes so plentiful in Wales as to destroy the plantations entirely. Otherwise it is a local insect, flying the first week in June, apparently as far north as Chat Moss, in Lancashire, and Bishops Wood, in Yorkshire. *T. stomoxyforme*, Hb. (Plate XV., Fig. 5), is a Continental "Clearwing," occurring from central Germany south to the Mediterranean, and distinguished by a broad ruby band across the middle of the body.

[SYNTOMIDÆ.—Of this family, one, a Southern insect, on bramble blossom in June, *Syntomis phegea*, L. (Plate XI., Fig. 3), has been reported British. But though it occurs as far north as Belgium, there is no reliable authority upon which to base the claim to a place in our lists. As will be seen, it is a decidedly "Burnet"-looking moth, and, being also a day-flier, is often associated with that family. But it seems to belong rather to the Arctiids, the Anthocerid resemblance being more or less accidental. I have found it very common at Chiavenna and Susa in north Italy, and in the Basses Alpes.]

B. VII. SUPER-FAM. ADELIDES.

FAM. ADELIDÆ.

ADELA VIRIDELLA, SC. (Plate XVIII., Fig, 13).—This little moth is one of a family remarkable beyond all other

lepidoptera for the elongated, thread-like antennæ, which are often as much as three inches long, and flash in the sun with iridescent splendour. By reason of this peculiarity the group is known commonly as the "Long Horns," though the word "horn" is hardly well chosen to express the delicate, burnished filament. The fore wings are green-gold, like a fresh oak leaf, and tinged at the edges with metallic copper; the hind wings brown, flushed with purple. The larva inhabits a flat-looking case, made from pieces of leaf, after the custom of the families nearest allied to it, and in the pupa it will be seen that the long antennæ are carefully coiled round the tail in a little bunch.

Six members of the genus to which *viridella* belongs are found in the United Kingdom, and they are most of them fairly common at the time when the woods assume their first perfect verdure, flying in sunshine, and often settling on the foliage of forest trees.

B. VIII. SUPER-FAM. ERIOCRANIIDES.

This super-family is placed at the bottom of series B in my adopted scheme of classification, but, as has been pointed out elsewhere, the most generalised, and therefore genealogically the oldest, of each series might reasonably be interchanged. The *Eriocraniides* are tiny moths, the nine or ten species credited to the north and central regions of western Europe bearing a near resemblance to each other.

ERIOCRANIA SPARMANNELLA, BOSC., may be cited as an example—the fore wings shining gold, with purple markings; the hind wings dark grey, with a tinge of purple. But they differ from the Micropteryx, at the bottom of series C, described on p. 262, in having no imaginal jaws developed. The larvæ are also miners in the leaves of birch, hazel, and other trees, much in the Nepticulid style (*cp.* p. 260);

and, as Mr. Wood has pointed out, the study of them is easy, all the unmined leaves being removed from a sprig of the food plant, and the sprigs then kept fresh in water so long as the larvæ are at work.

C. I. SUPER-FAM. SPHINGIDES.

THE HAWK MOTHS.

The Sphingid super-family includes our largest and finest British species. But a reference to the latest catalogues of Old World and New World "Hawk Moths" convinces us that the comfortable quart-in-pint-pot classification is altogether misleading, and that we really possess, not a number of moths belonging to one or two genera, but individuals of a number of genera. While it is necessary, therefore, to alter, and even enlarge, the generic arrangement of species met with in the British Islands, the specific names have undergone little change from those used by the older text-book writers.

The chase and collection of the "Hawk Moths" is rendered specially attractive, not only by their great size and beauty, but because as larvæ they present so wide a variation of colour and even marking. Nor are the true British species difficult to rear in captivity, provided cleanliness be observed, and care be taken to provide fresh food, and, later, when the time comes, to keep the pupæ sufficiently damp, so as to prevent the would-be imago dying a prisoner, pent in its pupal wrappings. On the other hand, there are one or two of the group which require special attention; and only in very rare instances will the amateur bring out his "Death's Heads," unless he forces them to maturity under artificial conditions of temperature. The number of indigenous species certainly does not exceed ten or eleven;

the rest of them, claimed as British, are obvious "accidentals," or the offspring of temporary colonisation. The Hon. Walter Rothschild and Dr Karl Jordan, in their splendid monograph of the *Sphingidæ* ("Novitates Zoologicæ," vol. ix.), have divided up the family into two groups, based on certain distinctive peculiarities of structure in the palpi or sense organs—viz., A, Asemanophoræ; and B, Semanophoræ—and I shall describe the various representatives of them in this order.

Fam. Sphingidæ. Group A. Asemanophoræ.

Sub-Fam. Acherontiinæ.

Herse convolvuli, L., the "Convolvulus Hawk," is an immigrant species, and most frequent in September on our southern shores, though known to penetrate even as far north as Aberdeen. But though under exceptional circumstances it has successfully maintained itself here, both as larva and pupa, it is none the less to be regarded as an adventurer, and in many seasons is not seen at all. The fore wings are grey, crossed by wavy lines of black, and towards the margin marbled lighter grey; the hind wings are also grey, with similar bands and markings, becoming lighter at the margins. The body is much the same colour, but the pink and black bands are distinctive.

The bluish-green egg is laid on the wild *Convolvulus arvensis*, the larva quickly feeding up in September to the last week in October. An early immigration implies earlier larvæ and the emergence of autumnal perfect insects; our winter pupæ never, it seems, attain the final phase, as they should, the following spring. The full-fed larva, with its ochreous-yellow dorsal markings, which pass from sepia-brown to whitish on the lines below the spiracles, is a handsome object, displaying also the characteristic Sphingid

"horn"; while the chestnut-coloured pupa, sometimes dug from the soil during autumn field work, shows the immense proboscis of the imago already fully formed.

The Old World range of the "Convolvulus Hawk" beyond Britain is extensive. A form of it occurs in the Pacific Islands; it has been taken at Wei-hei-wei and in Amurland.

ACHERONTIA ATROPOS, L. (Plate XIX., Fig. 1), THE "DEATH'S HEAD," is certainly the most striking moth of the British fauna, the curious yellow skull-and-cross-bones markings of the thorax at once accounting for its popular name, and the combination of Acheron and Atropos (Judge of the infernal regions) for genus and species! Nor is this "Jolly Roger" badge its only peculiarity. Both as larva, pupa, and as perfect insect, it has the unusual power in an insect of emitting sound, described variously—in the case of the larva, as like that of a series of electric sparks crackling; in the moth, as like the squeak of a rat, the shrill of a shrew-mouse, or the chirp of a grasshopper. That these weird cries are produced independently of the mouth organs is also indisputable, the best opinion being that they are due to the inrush and expulsion of air through certain cavities in the head. But from all time the combination of appearance and sound has exercised an effect on the superstitious, though nowadays the collector is not likely to be deterred by such "protective" armour as the "Death's Head" assumes from enriching his cabinets. The bluish eggs are laid on the potato, and the larva (Fig. 1*a*) often takes no longer than a month to complete its changes. When full fed, in structure and resting habit it closely resembles the "Privet Hawk"; the ground colour vivid yellow-green, with oblique stripes of purplish-blue and yellow. But, as with other Hawks, the larva varies in tint

2.
3.
4.

and marking, and has been figured the colour of the earth, with copper-red back, and sprinkled all over with white spots. The pupæ are often dug up in large quantities when the potato harvest is in progress, especially in the eastern counties and in Ireland, while it has been reported on the wing as far north as the Orkneys and Shetlands. But the general failure of the pupa to survive the British winter suggests again the necessity of constant immigration, at all events in Ireland and the far North.

HYLOICUS LIGUSTRI, L. (Plate XX., Fig. 1).—There can be no doubt of the claim to British origin of the "PRIVET HAWK," though in my experience the majority of cabinet specimens are the result of captive breeding rather than capture with the net at the flower beds which they affect at dusk. The fore wings are decidedly pinkish, mottled grey, darker towards the lower margins; the hind wings are traversed by a central and antemarginal black band on grey ground colour, the pinkish tinge again predominant at the wing-bases. The body is beautifully striped with brown and vivid pink. In its earlier phase the egg is laid on privet, and the larva (Fig. 1*a*), when ready for pupation, is coloured and marked very much as the green form of the "Death's Head" larva—the caudal horn decidedly large in proportion to the body. But the green is not the only form of "Privet Hawk" larva, Buckler, in his "Larvæ of British Butterflies and Moths," figuring a lovely dull carmine example, with the oblique lateral markings blue to white with black intermediate dashes. The pupa is subterraneous, and hibernates. *Ligustri* in the larval state is not rare in July and August; but the moth has a limited range in England, and is only found occasionally north of the Midlands. In Ireland and Scotland it is very rare. Never a free flier, it may best be looked for at dusk in the neighbourhood of the food plant.

HYLOICUS PINASTRI, L. (Plate XX., Fig. 2).—This is the "PINE HAWK" of the British authors, and, as its name implies, is associated with fir forests; but in England it is a doubtful native, though for many years it has haunted certain woods in Suffolk. The colour scheme of all the wings is slate-grey to brown, and the body striped like that of *ligustri*, but blue-grey in the place of pink. The eggs are laid in June on pine needles, the full-grown larva, with its purplish dorsal stripe and whitish-green striped body, closely mimicking the firs upon which it rests. It pupates in September, at the foot of the tree, in a slight cocoon at some depth below the surface, and emerges from May onwards.

MIMAS TILIÆ, L. (Plate XIX., Fig. 2), THE "LIME HAWK" of Linnæus, might with justice have been christened after several other trees upon which the larva (Fig. 3*a*) feeds; indeed, in my own garden it studiously avoids the limes for the elms, at the roots of which I turn up occasionally the black, "muddy"-looking pupa in September. The larva is proportionately small to the size of the moth; it is green, with the oblique lateral stripes of the Sphingid pattern yellow, edged with reddish-green; the caudal horn, blue above, with yellow dots below. Occasionally it will choose the crevices of the tree-trunk in which to pupate; but usually it burrows, and here I may repeat my experience of pupa-digging—that the best side of the tree is that facing north to east, *i.e.*, the driest. The moth itself is one of the most variable in colour of its genus—the fore wings shading from rosy- and ochreous-grey to green-grey, with a pronounced dark median band; the hind wings yellowish-grey, with an antemarginal greenish band, more or less accentuated. Cosmopolitan in its habits, the "Lime Hawk" is apparently as much at home in the London suburbs as in the country; but it hardly passes north of

the Midlands, its occurrence in Scotland and Ireland being excessively rare, or at all events unnoted.

SPHINX OCELLATA, L. (Plate XIX., Fig. 3), THE "EYED HAWK," is distinguishable from all other British species of the family by the large blue-pupilled ocellations of the hind wings, set in rose-carmine, while the fore wings are hardly less delicately coloured fawn grey, mottled and streaked with the softest olive-brown; the head on each side velvety grey, with a deep brown central mark on the thorax. The pale yellow-green eggs are laid in the early part of June on several kinds of poplar, and also on apple trees. When full fed the larva is a light sea-green colour, the oblique lateral stripes whitish, and the horn blue, with transverse yellowish-green bands marking the segmental divisions. In size and shape it is not unlike the larva of the "Poplar Hawk." The pupa may be dug up throughout the winter at the foot of trees, the perfect insect appearing in May and June. In England and Ireland it is generally distributed, but very rare in south Scotland, and not found farther north except accidentally.

AMORPHA POPULI, L. (Plate XIX., Fig. 4).—This is decidedly the commonest of the British "Hawks," and my earliest entomological recollections are connected with the discovery of the opal eggs of the "POPLAR HAWK" on the leaves of the Lombardy poplar in the little seaside coppices on the Lower Sandgate Road at Folkestone. The full-grown caterpillar is brilliant shagreen, after the last moult becoming bluish-green, with the oblique stripes yellow and green; the horn yellow. But it is liable to much variation, in some examples the green ground colour being almost bright yellow. The larva buries itself in the autumn, but, as a rule, does not at once pupate, the perfect insect emerging in May and June. The general colour of the fore wings is

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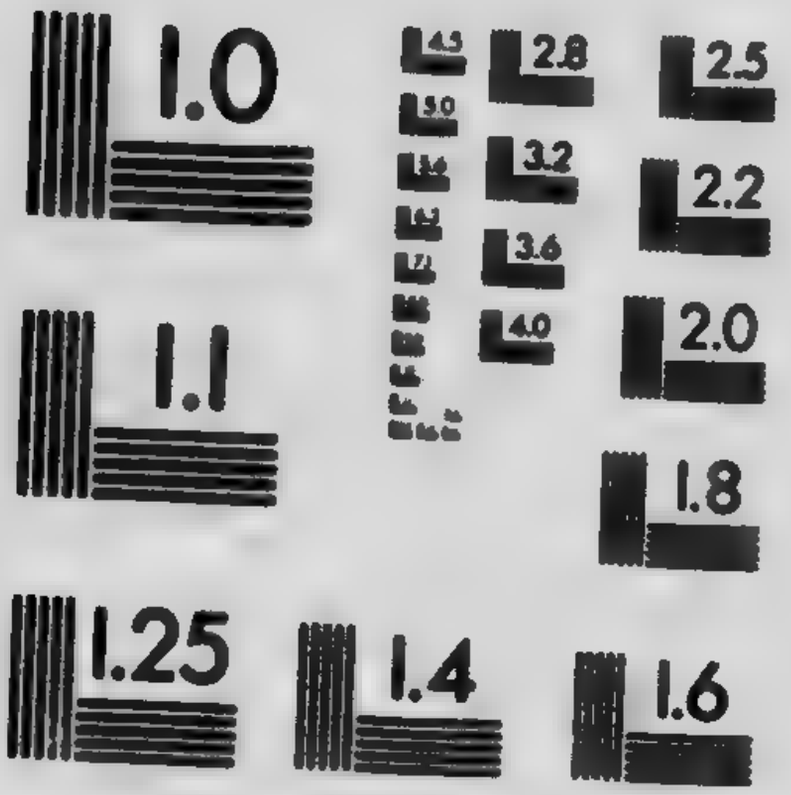

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ashen-grey with a pronounced median band of dark brown; the hinds wings have dentated margins, and are of the same colour as the fore wings, with a large red-brown blotch at the base. *Amorpha populi* frequents woods and planted open spaces where the food plants occur, and may also be caught napping on street lamps; and in suitable localities it flies over practically the whole of the United Kingdom.

Group B. Semanophoræ.

Sub-Fam. Sessiinæ.

Hæmorrhagia tityus, L. (Plate XX., Fig. 6).—In this division are two or three examples of "Clearwing" Hawks with bumble-bee-like bodies, the first of which is the "Narrow-bordered Bee Hawk." In the moth the central area of the fore wings is transparent, showing the black nervures; the marginal band, or border, is narrow, and blackish-brown; the hind wings are also transparent, with a very narrow border of brown. Both thorax and body are covered with thick yellow-gold hair, terminating in two black tufts, also divided by yellow. The green eggs are laid on the devil's-bit scabious as the female hovers over the plants; and the larva (Fig. 6*a*) when full fed is bluish-green, with a white longitudinal line, each segment being marked with a red-brown spot. It pupates in August in a slight cocoon just on the surface of the earth, and the perfect insect emerges the following May or June, and is generally distributed, though never common, throughout the United Kingdom.

Hæmorrhagia fuciformis, L., the "Broad-bordered Bee Hawk."—Both this and the "Narrow-bordered" are day-fliers, loving the sunshine, and in May and June *fuciformis* frequents the flowering rhododendron shrubs and the lowly blue bugle of our woodland rides. Generally it bears

a close resemblance to the last described species, but the marginal reddish-brown borders are much wider on both fore and hind wings. The green eggs are laid on honeysuckle, and the full-fed larva is pale green, with deeper green sides, the dorsal dark green line being supplemented by a yellowish line on either side. It pupates, at the end of July, on the surface of the earth, in an open cocoon of dirty-looking silk; and the perfect insect emerges the following spring.

Unlike *tityus*, it has only a restricted range of flight—in England to Yorkshire; while it is probably quite absent from Scotland and Ireland. I have seen it commonly on the Basses Alpes in June.

MACROGLOSSUM STELLATARUM, L., THE "HUMMING-BIRD HAWK MOTH," is perhaps the most universal of this family. At all times and in all places it appears, with its hovering swift flight—now poised with vibrant wings above the flower in which it has inserted its long, flexible proboscis, now darting away, so quickly that the eye can scarcely follow its movements, to skim some sunny, slanting wall, as though revelling in the refracted warmth. There is not a county unvisited by this rover; from the first warm days of the year—it may be in January—to the last flicker of December light, provided the air be mild, *stellatarum* is about. But, owing to this same continuous habit, it often happens that the larvæ of the later months are killed off as well as the too venturesome moths, and we have to wait—not usually a very long time—for a fresh immigration. The green eggs are laid on various species of bedstraw, and the full-grown larva is normally bright green, sown with white spots, and with two white lateral stripes, the caudal appendage marking it as a true Sphingid. Spinning a weak cocoon on the surface of the earth among the rubbish, it pupates at the

root of the food plant, but apparently never passes the winter in this phase.

In the perfect insect the fore wings are blackish-grey, mottled with ochreous ; the hind wings reddish-yellow, with darker borders.

DEILEPHILA NERII, L.—This immense green "Hawk," I believe, has never been found of late years in the larval state in England, and is at best a very rare visitant. The fore wings are bright olive-green, marbled with shades of pinkish- and whitish-grey ; the hind wings brownish-green, with a whitish wavy line inside the olive-green marginal area ; the body of the same vivid olive-green, with brownish-red marbling on the thorax. Years ago some larvæ were found at Eastbourne feeding on potato ; but it derives its popular name of the "OLEANDER HAWK" from the true food plant of the larvæ, which may not infrequently be found in Mediterranean countries on the oleanders tubbed outside the doors of the hotels. I have an exceptionally fine example taken in Constantinople. A powerful flier, single specimens have penetrated far inland in the United Kingdom—even to Aberdeen.

The following species, until I come to the "Elephant Hawks," are British only by courtesy, and though some may be found in England in the larval phase—occasionally in abundance—the majority are the progeny of visitors, or colonists on sufferance.

Sub-Fam. Chærocampiinæ.

CELERIO EUPHORBIÆ, L., is the "SPURGE HAWK" of our British authors, and though it ranges in western Europe from the Mediterranean to the Baltic, and there are plenty of records of its capture in Great Britain, most of the records require confirmation badly ; and no native locality can

possibly be named where the collector may hope to meet the beautiful *euphorbiæ*, while in some cases the appearance of its larva has been signalled by mistake for that of *C. galii*.

The fore wings are pale greyish, flushed with pink, becoming greener at the bases; the hind wings deeper brown-pink, with a strong black patch at the base, and a brownish-black band near the outer margin; the body olivaceous, with black and white bands towards the olive-brown and furry thorax. I have found the striking larva, which presents an astonishing variety of colour in as many individuals, on spurge plants by the roadsides in the Alpes-Maritimes. It is not difficult to rear, and it is noteworthy that it prefers the seeds and milky stems of the food plant to the leaves.

C. VESPERTILIO, ESP., THE "BAT HAWK" (Plate XX., Fig. 3), has never visited our shores; it is limited to central Europe.

CELERIO GALII, L. (Plate XX., Fig .4), THE "BEDSTRAW HAWK," has been more successful as a colonist than most of this migrant genus. Occasionally we hear of large numbers of larvæ being found on the East Anglian coast, and some years since I bred several from Lowestoft. In the general scheme of marking this moth is reminiscent of the preceding species, *C. euphorbiæ*; but it is smaller—the fore wings soft greenish-brown, with a creamy irregular wedge of white from the apex to the lower base; the hind wings creamy, with a reddish inside a snow-white blotch near the anal angle; the head and body olive-brown, with black and white lateral bars on the abdomen. The larvæ (Fig. 4*a*) are very variable in colour, both in the several moults and when full fed—blackish-green, olive-green or black-blue, also purplish; but as a rule with yellow segmental spots, set in bars of reddish-green or reddish-black. They may be looked for with best chance of success in May and June in those

localities where the moth has been known to occur—generally on the sand dunes of the coast, though in Scotland it has been reported from Loch Earn. It hibernates as a pupa, and is not difficult to breed in captivity.

CELERIO LINEATA, ESP., THE "SILVER-STRIPED HAWK," is another occasional visitor to our shores, though decidedly more constant in its coming than *D. nerii*. It can be mistaken for no other one of the group, however, with its beautiful pink and grey hind wings, its taper black-and-white-banded brown abdomen, and fore wings of olive-brown, with wide silvery stripe passing obliquely from the apex to the lower base. A world wanderer, in its habitats north of the Mediterranean the larva feeds on the vine and upon virginia-creeper, as well as upon bedstraw. But it evidently requires a much more even and genial temperature than Great Britain affords to pass through its metamorphoses, since it seldom or never arrives here before September or October, coming to light, or more often being found at rest on a fence or window-pane; and I once saw one taken on a gravestone in a Middlesex churchyard [illegible] at home in Australia, Africa, Asia, and the P[illegible] not surprising that so swift and strong a moth sh[illegible] as far north as our islands. Certainly it has no claim to a place in the list of the native-born.

PERGESA ELPENOR, L. (Plate XX., Fig. 5).—This beautifully coloured moth has deserved a better fate than to be known as the "ELEPHANT HAWK"—a name derived from the extraordinary markings and shape of the larva (Fig. 5*a*). Head, body, and fore wings present shades of rose-pink and olive-green, blended into perfect harmony; while the hind wings are rose-pink, with black at the bases. The pale green eggs are laid on the under side of the leaves of marsh bedstraw, willow herb, and wild balsam in July, and when full

fed the larva is bright green, the body markings and ocellated spots giving it that "terrific" appearance which is supposed to scare away the enemy clever enough by daylight to detect the already concealed larva as it clings motionless to a leaf. For it is a night-feeder, and the "warning" marks can hardly be supposed to operate after dark! Brought up on water weeds, it is recorded that *elpenor* is impervious to water, and can float in safety for a considerable time should it happen to fall from its food plant. But in general appearance this remarkable larva suggests the head of a pig, as observed by French writers, rather than that of an elephant. The pupa hibernates in a slight cocoon on the surface of the earth, from which it is able to force an exit preparatory to the emergence of the perfect insect. Early June is the normal time for its appearance, with occasionally a partial autumnal emergence. Very rare in the North, and unknown in Scotla ., it is widely distributed, but never common, throughout the ast of the United Kingdom.

PERGESA PORCELLUS, L., THE "SMALL ELEPHANT HAWK MOTH," in all its phases bears a close resemblance to *P. elpenor*. But the perfect insect is very much smaller; the colour scheme of the wings is less vivid, and the fore wings yellowish, with a tinge of olive-brown, blotched with rose-colour, the outer margins of the same tint, the hind wings a combination of ochreous and rose. Also a bedstraw-feeding species, the vivid green egg is laid on *Gallium verum* or *G. mollugo* in June. The larva, which is coloured, marked, and provided with the "Chinese mask" apparatus for warding off attack, much as *elpenor*, affects dry land rather than slough. Full fed about the end of August, it spins a cocoon on the surface, under moss or grass, and, hibernating as a pupa, the perfect insect appears the following June. Occurring in all the three Kingdoms, it especially affects

chalk downs and dry meadows, while I have taken it on Middlesex commons, clinging to low trailing honeysuckle among ling.

C. II. SUPER-FAM. ATTACIDES.

This super-family numbers among its members the largest moths in the world. Nearly allied to it is the whole race of silkworms (*Bombycides*), of which one at least, *Attacus cynthia*, has acclimatised itself from eastern China on the Paris boulevards, where the spectacle of these grand insects at the electric lamps will always draw a crowd of admirers. *Saturnia pyri* and *S. spini* (Plate XXI., Fig. 4) are also among the biggest moths of western Europe, and nearly related to them is the curious "silkworm"-looking *Aglia tau* (Plate XXI., Fig. 5), known colloquially in France as the "Hatchet Moth" from the white markings within the large blue "eyes" of the hind wings. The male flies in the clearings of the beech woods between 10 A.M. and noon, and is extremely rapid on the wing. I have seen many examples taken in April in the forest of Versailles.

Sub-Fam. Saturniinæ.

SATURNIA PAVONIA, L., THE "EMPEROR MOTH," varies greatly in colour and appearance as between the sexes. The males are smaller than the females and very active on the wing, flying hither and thither in the spring sunshine over the heather on our commons and moorlands. The female, with her huge grey furry body, seldom moves from the plants selected for laying her eggs upon; and if a virgin female be placed in a little muslin cage, and taken where the males fly, numbers of would-be suitors will assemble to court the captive. They are splendidly coloured and marked—the fore wings marbled purplish-grey, with car-

mine blotches at the apex and two large ocellations towards the centre; the outer margins grey-white; the hind wings generally warm yellow-brown, with rather smaller central "eyes." The antennæ of the male are strongly pectinated. The female displays little or none of the yellow colouring, but is purplish-grey, with white marginal borders and marblings to the wings. The eggs are arranged systematically in batches. The full-grown larva is about an inch and a half long, bright green, with black bristles, of which the bases are yellow. Earlier it is black, with orange rings or stripes. The cocoon is like a sort of inverse lobster-pot, from which the moth can emerge, but nothing else can enter. The "Emperor" is not infrequent in suitable localities from April to June, and is occasionally even a hedgerow species.

C. III. SUPER-FAM. DIMORPHIDES.

Fam. Dimorphidæ.

Dimorpha versicolora, L., the "Kentish Glory" (Plate XXI., Fig. 2), originally may have shed lustre upon Kent when Darenth Wood gave its oaks to the British navy but it is a fact that this fine moth has not been recorded in the north of the county since, and that to-day the ominous word "formerly" is appended to the great majority of its habitats in the south-east. However, it is not uncommon in the Reading district and in Worcestershire, and occurs somewhat plentifully in several Scotch localities. The fore wings of the male are red-brown; and two black lines, edged on one side with white, traverse the median area; the discoidal spot >-shaped, and a series of white antemarginal blotches. The hind wings and body are tawny orange-brown, in the female reduced to faint yellowish-white, with a corresponding diminution of colour on the

fore wings. The full-fed larva is not unlike that of a "Hawk Moth" in general appearance, and adopts the same rest attitude. When quite small it is entirely black; in its last moult, when about an inch and a half long, it is brilliant green, with oblique yellow-green stripes and a caudal horn of the same colour, the lower part of the body shagreen, towards the tail extremity sometimes with reddish-brown markings. It feeds on birch and alder, passing the winter as a pupa, and the perfect insect dashes wildly about over heather with *Saturnia pavonia*, or in birch woods when the April sun is at noon. Like the "Emperor," also, the males may be lured to captive females.

C. IV. SUPER-FAM. LACHNEIDES OR LASIOCAMPIDES.

In this super-family are grouped the stout-bodied moths known familiarly as "Lackeys" and "Eggars," and they are sure to be among the first to attract beginners by reason of the imposing size of their hairy and often brilliantly coloured larvæ.

FAM. LACHNEIDÆ.

Sub-Fam. Pœcilocampinæ.

PŒCILOCAMPA POPULI, L., THE "DECEMBER MOTH," is a not unfamiliar object in November and its name month, clinging to the glass sides of the lamps in suburban roads where the original woods have not been altogether crowded out by villas. Some years it is common in north Middlesex; in others I hardly notice a half-dozen throughout the winter. The wings in both sexes are semi-transparent, with light scaling—the males blackish-brown towards the base of the fore wings, the females of a rather warmer tint. The larva feeds on hawthorn, birch, etc.; it is bluish-grey, the dorsal

line intersecting a series of brown-black segmental blotches, each of which carries two small orange-yellow spots. The pupa is spun up in bark or among dead leaves. The perfect insect is to be found in Britain to Cromarty, and in Ireland.

Sub-Fam. Trichiurina.

TRICHIURA CRATÆGI, L., the "PALE OAK EGGAR," is about the same size as the preceding moth—the male, as a rule, with greyish fore wings, and a median band of darker colour edged with brown; the female greenish-grey, and the band less conspicuous. The larva has almost as many forms as it has food plants, though blackthorn I find the most favoured. In the commoner form the back is black, ringed with yellow; and upon each ring are two crimson spots, with a spiracular row of small white dots and "tooth-brush" tufts of reddish hair. The pupa, which is confined in a very compact egg-shape cocoon, may be found in July, the perfect insect in the two following months; and it has a wide range of distribution in the woodland counties.

LACHNEIS LANESTRIS, L., THE "SMALL EGGAR," rather resembles the last named species, but all the darker markings are warm brown, and both male and female are adorned with a conspicuous white discal spot; in the female also a bushy grey tail-tuft, which is used, as with the "Gold-tail" (p. 157), to cover and protect her eggs. These are laid, in February, on whitethorn and sloe. The larvæ, living in families under webs, when full fed are handsome, velvety black fellows, with large yellow-ringed spots. The cocoons are the orthodox egg or "eggar" shape, and the moths sometimes remain in them for two or even three years, if the season is unfavourable for emergence, as it often is so early in the year as the second and third months.

MALACOSOMA NEUSTRIA, L. (Plate X., Fig. 5), THE

" LACKEY MOTH," the larvæ of which are often exceedingly common on all sorts of garden shrubs (I have found them even on laurel), is seldom, if ever, met with on the wing, unless occasionally attracted to light. One wonders, indeed, what becomes of all the millions of moths which must be reared, year in, year out, from the numerous webs and associations in which the young larvæ live. For I have noticed that they are seldom ichneumon-infested, while birds will hardly touch them. When full fed they are sufficiently prominent objects on the food plant they select; the ground colour bright slaty blue, a white line traversing the whole body length of the brick-red dorsal area, and a red line lower down; the head blue, with four curious black blotches. The pupa is " cradled " in a blackish cocoon, and powdered yellow (as is also the pupal case) by a dried fluid ejected from the larva. The moth is canary-brown to dark brown, with a median band margined darker. It flies in July and August.

Somewhat similar, but with an even more magnificently arrayed larva, is the " Ground Lackey," *M. castrensis*, L., the two species artificially producing hybrids in great variety. But in Nature *castrensis* is a very much rarer insect, preferring the salt-marshes of the Thames, where the *artemisia*, beloved of the " Essex Emerald," grows. In captivity, therefore, it is as well to spray both plant and larvæ with slightly salt water.

LASCIOCAMPA QUERCÛS, L. (Plate X. Fig. 6), THE " OAK EGGAR," has always been a great favourite for rearing with collectors. The males are a rich mahogany red-brown, with yellow antemarginal bands on all the wings, and yellow fringes; the female, which is an enormous-bodied insect, and much larger, light ochreous brown, the area between the lighter antemarginal band and the body, reddish-brown,

the discal yellow spots large and prominent. The larva when full fed is warm brown, the segments ringed with velvety black, and, lower down the sides, ornamented with white upon reddish and black markings, the whole covered with downy hair. The cocoon, about the size of a blackbird's egg and quite as hard, is to be found among débris at the foot of oak and other trees. The males of this genus love the bright sunshine, dashing about at a tremendous rate—so rapid in their flight, indeed, that I have often wondered what the *butterfly* might be spinning through the Mediterranean ilex woods at this headlong pace, and after many unsuccessful shots with the net landed it, only to discover that after all it is another *quercûs!*

Very closely allied to it is the "Northern Eggar," *L. callunæ*, if it be a true species—for nowadays it figures as a variety of *quercûs*. In this form, however, the males and females are of much the same colour, and rather darker reddish-brown than the type. It occurs on most of the moors from Yorkshire to the Orkneys; but the larva hibernates, and, judging by the mortality from damp and fungus of both "Eggars" at this period in the breeding-cage, I think vast numbers must perish in this way also in Nature, for the percentage of moths on the wing is wholly disproportionate to the quantities of larvæ seen feeding in the autumn on the heather.

MACROTHYLACIA RUBI, L. (Plate X., Fig. 7).—The same remark as to the death rate among hibernating larvæ applies with even stronger force to the "FOX MOTH." I have seen the moors at Edinample, in Perthshire, literally strewn with them, but the keepers seldom noticed the moths in the spring, while attempts to bring them through under cover have resulted in more failures than successes. When full fed they are extremely velvety in appearance—the back bright

red-brown upon black, the hairs on the side bluish; the cocoon, spun up among the heather on which the larva feeds as well as on other plants, is tough and tubular. The male moths vary much in the shade of brown—sometimes reddish, justifying the popular name, at other times ochreous yellow, with two transverse lighter lines towards the centre of the fore wings; the female larger, paler, and greenish in tint.

The males, like those of *quercûs*, revel in the warm June sunshine, careering wildly over the moors. The females are of more sober gait; their flight is also confined to the night watches.

COSMOTRICHE POTATORIA, L., THE "DRINKER MOTH," from time immemorial has enjoyed its English name in compliment to the known predilection of the familiar hairy yellow-and-black-dotted larva for dewy grass and rain-swept pastures, and is one of the very first larvæ to be taken and bred by collectors. As hibernators, and, like the preceding moths, by no means easy to carry successfully through the winter in captivity, they are better taken "wild" as they approach full growth from April to early June. The oblong cocoon is spun of yellowish silk, and attached head upwards to a grass stem. The moth is in shape and contour not unlike the "Fox Moth"; but the males are a softer ochreous, with a double discal spot, and the females brighter yellow ochre, with the same discal markings, the sex colours, however, being occasionally reversed. In this phase it is usually common in localities where the grass is lush and abundant.

GASTROPACHA QUERCIFOLIA, L. (Plate XXI., Fig. 1).—From a peculiarity of the larva, also, this magnificent moth has received the name of the "LAPPET." To the eighteenth-century "Aurelian" it was the "Caterpillar with

the Lappets "—the little "lap" or flap of fleshy skin, covered by the brown fluff which fringes its sides. Otherwise it is an immense creature, dark in appearance, almost black, and generally hairy. On the third segment from the head there are two prominent white marks, and in some examples these are multiplied all down the back. The whitish egg is laid on sallow, apple, etc., in July. The larva hibernates, resuming business as soon as the leaves are on the trees, and spinning a cocoon for pupation among the branches. The moth is plentiful in the fens, rare in the North, and fairly common in the South, but not yet reported from Ireland and Scotland. At rest it may be at once distinguished by the peculiar habit of extending the hind wings at right angles to the body, and covering them roof-wise with the fore wings—a movement rather suggestive of some "Skipper" butterfly on a large scale.

DENDROLIMUS PINI, L. (Plate XXI., Fig 3).—This fine "Drinker"-like moth does not occur in England, though a single example was netted in Norwich about a century since, but is distributed from the north of Europe to south Greece, the larva feeding on pine, as its name implies. The fore wings are dove-coloured, with a broad dentated antemarginal brown base, and the discoidal spots white, with a basal blotch of darker brown. In the alpine form (=*montana*, Stgr.) the antennæ are strongly pectinated, and the brown markings and ground colour, especially of the hind wings, darker, and richer brown; and moth flies from the end of June into August.

C. V. SUPER-FAM. PTEROPHORIDES.

THE PLUMES.

These interesting branches of the super-family, which we recognise collectively as the "Plume Moths"—the name

bestowed on them two centuries since by Réaumur—have come in quite recently for a regular overhauling at the hands of the late J. W. Tutt, our latest authority on the subject. And here, once again reverting to our previous definition of classification as "a record of facts," we find the convenient but unscientific method of lumping the thirty British species into the one or two genera hitherto allotted them to be misleading. I can only regret, therefore, that when the re-arrangement was established on a correct basis the reviser should have thought fit to invent a series of race names which, however gratifying they may be as memorials of so many distinguished entomologists, defy alike the classic rule and the elements of harmony!

Fam. Agdistidæ.

Agdistis bennetii, Curtis, the "Seaside Plume," and British representative of this genus, is characterised as an Agdistid by the absence of the cleft of the fore wings, and by the hind wings being undivided into plumules, as with the British Alucitids. The genus, indeed, is thought by some to constitute a connecting link, as it were, between the normal whole-winged Pyralid moth, and the bird-like pinioned "Plume Moth" proper. The normal colour of the wings is shining grey, with short black streaks and four black dots placed longways across from the costa to the inner margin. The larva feeds on the leaves of sea-lavender, *Statice limonium*, in the salt-marshes of the Thames and Medway, and a slightly smaller form is reported from Portland Cliffs. When full fed it is bright green, speckled with small white dots, with a reddish "horn" on the twelfth segment. It hibernates from October, but all the time it is liable, as we have seen with other salt-marsh species, to

immersion by the tides. The first emergence of the perfect insect takes place in June; the second, and more abundant, in August.

FAM. ALUCITIDÆ.

STENOPTILIA PTERODACTYLA, L., THE "STONE PLUME," is a very widely distributed species, occurring in suitable localities from the southern counties to Perthshire, and, indeed, in most places where the common speedwell, *Veronica chamædrys*, the food of the larva, grows. The fore wings are cinnamon-brown, the outer margin finely cleft, the hind wings "glossy brown, slightly darker towards the outer margin and apex of the plumules." The egg is laid towards the end of June on the under side of the leaf; and the young larva mines into the stem, proceeding to hibernate long before autumn. In April it starts feeding on the leaves, flower buds, and unripe seeds, and when full fed is either grass-green or bright yellow-green, with apparently darker marking on the back, and indistinct lateral lines of greyish-white. The pupa, which in colour rather follows that of the larva, is suspended by the tail, and the perfect insect emerges from early June to soon after midsummer, being single-brooded.

PTEROPHORUS MONODACTYLUS, L. (Plate XVIII., Fig. 16), occurs twice a year—in June and July, and again in September and October—and sometimes bears a close resemblance to the foregoing "Plume," from which, however, it is to be distinguished by the narrower wings, and usually smaller size. The larva is described as "dingy green, streaked and spotted with whitish, with a dorsal stripe of dark green or reddish-brown, and covered with tufts of pale brown hairs." It feeds on the flowers, buds, and leaves of convolvulus from June to September, the perfect insect of the second emer-

gence hibernating, and when at rest on walls and palings, by folding the hind wings under the fore wings, it resembles in this position "a T-shaped piece of hay or straw."

ALUCITA PENTADACTYLA, L., THE "WHITE" OR "PHANTOM PLUME," though one of the commonest of the group in the east and south of England, is also one of the most beautiful. The plumules of the fore and hind wings are all pure satin-white, and when at rest it extends them fully, so that in the day-time it is a conspicuous object on the grass. And, curiously enough, the larva when hatched is white also, clothed with long white hairs. Hibernation, however, commences very soon, but during April and early May the hairy larva feeds up rapidly, and when full-fed is exactly the colour of the convolvulus leaf; the dorsal line apparently darker green, and the ninth segment lemon-colour. The grey-green pupa is suspended by the tail from a leaf, and the perfect insect emerges in the first week of June.

FAM. ORNEODIDÆ.

ORNEODES HEXADACTYLA, L. (Plate XVIII., Fig. 14).—This, commonly called the "MANY PLUME," but by Wood the "Many-Fingered Moth," by reason of the four-and-twenty plumules of which the four wings are composed, has been separated properly from the Plumes, and is the sole representative of its family in Britain. The fore wings are yellowish-brown, with central and marginal bands of darker colour. The series of plumules of the hind wings have the appearance of being washed over with whitish-grey, and when resting, as the insect does, with extended wings, it presents an almost complete semicircle, and in this respect is quite unlike any other British moth. It is an indoor-loving insect, and I have found it repeatedly in January clinging to walls and the timbers and thatch of barns. The

larva feeds on honeysuckle. When full fed it closely resembles a pink maggot, according well with the flowers on which it lives. It spins a slight cocoon in which to pupate, and the perfect insect emerges in July and onwards, occurring as far north as Aberdeen, and in Ireland.

C. VI. SUPER-FAM. PSYCHIDES.

The latest classification of this super-family reduces the number of "Micros," as they were formerly known, and brings from the Tineid groups a considerable accession to the Psychids. And a very remarkable super-family they are: the males of all species more or less black, with thin scales on the wings—hence the popular name of "Chimney Sweepers"; the female wingless, and sometimes legless, never leaving the cocoon in which the larva has pupated, and, after laying her eggs on it, quickly dying. In some cases, however, the female does contrive to get out of the cocoon, leaving the pupal case behind her; but, being unprovided with wings, she can take no part in the giddy flights of the male. The odd part of it is, also, that in some cases the female pupa appears to be provided with wing cases, as in those of other families, but the resulting insect none the less is apterous. I have sometimes seen the black males of a species of "Psyche" flying in thousands over the broom bushes of the Mediterranean Alps in late June; but, so far as observation goes, the individual life is shorter in the imago stage than that of any other moth or butterfly. *Pachytelia unicolor*, Hufn. (Plate XV., Fig. 7), a large moth of its kind, occurs in central Europe, and is common in June and July. *Fumea casta*, Pal., Haworth's "Chimney Sweeper," may be taken as a good example of these remarkable insects. As I have stated, the eggs are laid in or on the cocoon of the female moth, and apparently the larvæ will

eat almost any growing food from oak leaves to moss. As soon as they are hatched they construct a case for themselves from the silk which covers the eggs in the parental cocoon. Later their homes are strengthened with particles of straw or food stuff; and in May, when they climb up for pupation, they may sometimes be found in quantities on trees, fences, etc. From their peculiar habit of carrying about their houses with them, the larvæ have received the name of "Basket Worms"; but while some, like *casta*, "build" with pieces of stem or anything else that comes handy, others are content with the silk alone, and this hardens into a sort of shell, resembling that of a tiny *helix* or land-snail. So perfect, indeed, is the imitation, that Dr Sharp says the specimens in the British Museum were actually sent there as shells of Mollusca. The perfect insect flies from June to mid-July, and is common as far north as the Clyde, and in Ireland.

C. VII. SUPER-FAM. ANTHROCERIDES.

Fam. Anthroceridæ.

This family includes as sub-families the *Adscitinæ*, or "Forester Moths," and the *Anthrocerinæ*, or "Burnet Moths": the first mentioned, so far as British species are concerned, distinguished by the brilliant bronze-green blue fore wings; the latter by the dark blue-black crimson-spotted or marked fore wings, and hind wings of plain crimson. They are all day-fliers, sharing with the butterflies the flowers of our early summer downs and heaths, and constitute, perhaps, the loveliest of the smaller fry, their clubbed antennæ heightening the resemblance they seem to bear to butterflies, though their stout bodies at once proclaim them moths.

Sub-Fam. Adscitinæ.

ADSCITA STATICES, L. (Plate XII., Fig. 13).—We have but three British "Foresters"—*statices*, *globulariæ*, and *geryon*—of which *statices*, *the* "FORESTER," is the commonest. The colour of the wings is as described above, with smoky grey hind wings. The young larva mines the leaves of sorrel; after hibernation it attacks the lower leaves. In colour it varies from pinkish to dirty white, with a dorsal line to match, and a broad pink lateral stripe. It spins a thin white cocoon attached to the stem near the ground, the perfect insect flashing over meadows and "roughs" in the May sunlight as far north as Inverness. *A. pruni*, Schiff. (Plate XII., Fig. 12), is not a British species, but has a wide range of distribution on the Continent from north Finland to the Mediterranean. The larva feeds on blackthorn.

In the same group may also be reckoned the charming little moth so dolefully named *Aglaope infausta*, L. (Plate XII., Fig. 11), which inhabits mid-Europe to south Italy and Spain, and often is very common on the sloe hedges in June, so that some French entomologists have called it the "Hedge Sphinx."

Sub-Fam. Anthrocerinæ.

ANTHROCERA LONICERÆ, SCHEVEN (Plate XII., Fig. 9).—This, the "NARROW-BORDERED FIVE-SPOT BURNET," is the largest of our British Anthrocerids. The fore wings are deep green or blue-green, with five carmine spots, the hind wings pure carmine, with a *narrow* blue-black border, the "Burnet" with the *broad* border being *A. trifolii*, which, unlike *loniceræ*, exhibits an astonishing range of variation. It haunts rough fields and wastes, and in the Alps the

flowery slopes of the mountains. The larvæ of all this genus bear a close resemblance to one another—that of *loniceræ* very plump, the ground colour a velvety bluish-green, with lateral black velvety blotches divided by a series of pale yellow marks. It is slightly hairy, and after feeding on vetchling, trefoil, and other allied plants, first in the autumn and then in the spring, it spins a hammock-shaped cocoon (set up on end) on the stems of grass. England, North Wales, and Ireland all furnish localities.

ANTHROCERA FILIPENDULÆ, L. (Plate XII., Fig. 10), THE "SIX-SPOT BURNET," is the commonest of its kind—in normal examples the fore wings carrying six spots, the carmine hind wings with a narrow dark marginal band. And in this species as in most of the group, the carmine is, very rarely, displaced by pale or brilliant yellow. All three insects mentioned have also the habit of cross-pairing, so that it is often extremely difficult to determine the species when captured. In May and June there is an early emergence of what has been considered *filipendulæ*; but, despite the strong resemblance of the one insect to the other, this is now ascribed by the chief authorities on the genus to *A. hippocrepidis*, Stephens—the hind wing marginal border broader than usual in *filipendulæ*, the lower and outer of the pair of spots on the fore wings ill-defined. Our "Six-spot Burnet" flies in July and August in much the same localities as *loniceræ*, and the larva is responsible for the yellowish cocoons so common on grass bents in June and July. The Anthrocerids are singularly tenacious of life, and a dose of cyanide, which will kill most big moths in a few minutes, is rather enjoyed, apparently, than otherwise by the lively Burnet.

C. VIII. SUPER-FAM. HETEROGYNIDES.

Fam. Heterogynidæ.

Heterogynis penella, Hb. (Plate XII., Fig. 8).—I have introduced this little black moth, which occurs chiefly in the south of Europe, as providing a link in the family chain between the Anthrocerids, or "Burnets," and the also black-winged *Psychidæ*. The larva resembles them in shape; it spins much the same sort of cocoon; but the female, as with the Psychids, is little better than a grub, and never leaves the cocoon in which she is born, and where she lays the eggs which are to provide the next generation.

C. IX. SUPER-FAM. COCHLIDIDES (or EUCLEIDES).

Fam. Cochlididæ.

Of this numerically small super-family we have in Europe but one example of the two contained genera, *Cochlidion* and *Heterogenea*, both of them also British. And at this point in series C it will be observed that I pass to species which hitherto have been included by most of the earlier writers with the "Macro" or larger Lepidoptera.

Cochlidion avellana, L., is popularly known as "The Festoon." The fore wings of the male are brown; of the female yellow ochre. There are two transverse lines, one in the centre, another dividing the area near the apex from the rest of the wing, and a third short one from the inner margin upwards, the whole forming the "festoon" which gives the moth its English name. The hind wings in the male are darker brown, with orange-brown inner and outer margin. The most interesting phase of *avellana*, however, is the larval.

As the word *Cochlidion* implies, the larva is snail-like, being, in fact, without the prolegs we find in other lepidopterous larvæ, and having in their place "suckers," by which it moves over the oak leaves, leaving a trail of silky matter not unsuggestive of the snail. In general appearance it is leaf-green, with yellow edges to the protuberant sides, and with red-edged yellow lines on the back. After winter pupation the males fly at midsummer high among the woods in the sun. The female, apparently trusting to colour rather than swiftness for protection, may be jarred from her perch on the foliage; and both sexes are fairly common in the south-eastern counties and as far north and west as Bucks. and Worcestershire.

HETEROGENEA CRUCIATA, KNOCH, THE "TRIANGLE"—so called from the triangular-shaped black-brown wings of the little male—appears to have no sort of relation with the preceding insect. But the larva is another of the "snail" tribe, only smaller, and more resembling a louse in form. It is when full fed pale yellowish-green, with a broad olive-brown "saddle" mark on the back. It spins a gall-like cocoon on the leaf of beech or oak, in which it passes the winter, but does not actually pupate until the following May. The perfect insect has only been detected in a few forest localities of the south, at Epping, and in the beech woods of the Chilterns.

C. X. SUPER-FAM. NEPTICULIDES.

The Nepticulids boast of their number the smallest known species of Lepidoptera. To most of us they are more familiar in their larval phase; or rather, I should say, we are best acquainted with them through the peculiar "hieroglyphics," or "mines," with which the larvæ adorn the

upper sides of the leaves in which they feed. In these galleries some of the species pass the whole of their preliminary phases, the larvæ spinning their tiny cocoons in the mine or burrow which they have worked. The perfect insects are day-fliers, loving the sunshine, and hiding in dull weather and by night in the crevices of tree-trunks, or resting quietly on fences. Of the British species—about eighty in all—some mine the leaves of rosaceous bushes and shrubs, and plants; the rest are divided on acorn, catkin, and fruit-bearing trees, and a few on low-growing herbs. Some idea of the antiquity of their habit as leaf-miners may be formed from the discovery of traces of the kind "in a leaf found in brown coal of the Lower Miocene age." In view of the size of the perfect insect, however, and the difficulty of "spotting" them, they are best bred—a simple enough process—by collecting the mined leaves, keeping them moist, and transferring them to a separate small glass tube, where pupation is accomplished, and the moth eventually emerges.

NEPTICULA AURELLA, F., called by Wood the "GOLDEN PYGMY," is a typical member of the group. The workings of its amber-coloured larva must be familiar to any one who gathers the lovely autumn foliage of the bramble, and it will further be noted that the mines are confined entirely to the upper side of the leaf. There appears to be a period of rest during the winter, though the bramble does not shed its leaves entirely, and the curious fact has been noted that the mined leaves stick on the longest. Also, when it has spun its cocoon the larva remains motionless inside for some days, finally turning into a pupa, the head and wing cases of which resemble thin glass, the abdomen sulphur-colour. Continuous broods of this moth follow one another in mild seasons, and the perfect insect is a radiant little creature.

The fore wings are golden brown, tinged with purple and deep violet at the apex, and adorned across the middle with a gold oblique stripe ; the hind wings grey. It is reported as far north as Aberdeen, and Fermanagh in Ireland, while generally plentiful in most of its known English haunts. *N. plagicocella*, Stt., another Nepticulid, enjoys the reputation of being the minutest of all British moths—that is to say, with a total wing-expanse of about one-fifth of an inch.

C. XI. SUPER-FAM. MICROPTERYGIDES.

Fam. Micropterygidæ.

Micropteryx calthella, L.—The super-family to which this tiny moth belongs, " historically " speaking, is among the most interesting of all the moth families developed from the original moth ancestor (*cp.* Table of Descent, Part I., p. 31). Reckoned by geological periods, the *Micropterygidæ* may indeed be accounted the most ancient of all our Lepidoptera, and this naturalists determine by the simplicity of structure exhibited in the several phases of the insects as we know them. A glance at the " Family Tree " shows Micropteryx at the top of one column, Hepialus at the top of another, and the Eriocraniids at the top of the third. Fossil remains of small insects are necessarily few and far between ; we have no more evidence, therefore, of the antiquity of the most primitive survival than can be determined from its structure. Further, in this case, and by such means, the researches of Dr. Chapman establish beyond reasonable doubt that this family is actually on the same stem, so to speak, and near to the foot of it, as the " Hawk Moths " themselves at the other end. With their many comparatively big descendants they have features in common to

this day; though, of course, innumerable connecting links have fallen out in the long intervening ages. But structurally the group is distinguished from all other lepidopterous insects by the presence of "jaws" in the perfect insect.

Were *M. calthella* the size of an ordinary "Burnet Moth"—that is to say, of yet another of its posterity—it would be acclaimed as the most gorgeous insect of our island fauna. "The fore wings," wrote Linnæus just one hundred and fifty years ago, "appear in certain positions to be all of gold." And greenish-golden they are, with the bases purple, the hind wings bronze-grey, the male even more minute than his tiny mate. Such is the "BUTTERCUP ATOM," as one might christen *calthella* faithfully to its size and habitat. For the pollen of the flowers of the marsh marigold and of the buttercup is the food of the perfect insect, though the eggs are laid among damp moss; which act accomplished, the parent dies beside them. The microscopic larva is distinguished by a pair of head-horns, and when sufficiently wet moss is lacking it quickly dries up. In its structure it combines not a few of the characteristics of the Caddis "Worm" with those of the lepidopterous insect. It spins a yellow silk cocoon, and the moth makes its appearance in May and June, a single buttercup bloom having been found to contain as many as thirty individuals.

Six species of *Micropteryx* are known in Britain, and of them *calthella* occurs from Devon and Kent in the south to the Orkneys.

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